The Nature and Performance of China's State-owned Enterprises

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Candidate's Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of the author's knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.

Paul C. Hubbard

Date:
11 November 2018

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Abstract

Much commentary and analysis conceives of a generic Chinese 'state sector' which is stubbornly inefficient and, sometimes simultaneously, the central pillar of an assertive 'state capitalism'. This thesis argues that the nature and performance of state ownership varies across the Chinese economy in ways that can't be reduced to homogenous 'state' or 'non-state' sectors. The introductory chapter recalls China's transition from a planned industrial state monopoly to a mixed economy in which non-state firms dominate state-owned enterprises' (SOEs') share of activity in competitive sectors.

Chapter 2 argues for SOE performance to be assessed according to the sector in which it operates, and the state owner's objectives therein. Where an SOEs is operating in market that depart from conditions of perfect competition, or when the state owner's objectives encompass broader policy goals, the maximisation of profits may not be a good benchmark for an SOE's contribution to the economy, or social welfare more broadly.

Chapter 3 surveys the sectoral distribution of state ownership and reveals the diversity of state owners. Projecting from current fixed-asset investment shares, it shows that China's share of state ownership in aggregate is approaching levels similar to OECD mixed economies such as the Netherlands or Sweden. While China's largest corporate conglomerates tend to be controlled by the central government, these prominent 'national champions' are not representative of state ownership more broadly. Ownership rights over most of China's 160,000 SOEs are exercised directly by hundreds of state owners, including at the local level, or indirectly, by other SOEs.

Chapter 4 tests the extent of state monopoly within China's vast array of industrial sectors. Monopoly is measured by the Herfindahl-Hirschman Index (HHI) of market concentration in 521 industrial subsectors using enterprise-level data. To account for the SOE conglomerates observed in the previous chapter, a novel adjustment is made to group SOE observations according to their administrative relationship (*lishu guanxi*). These estimates confirm that large central state monopolies remain in oil (a strategic resource), electricity (a network utility) and tobacco (an administrative monopoly). By contrast, Chinese manufacturing subsectors are mostly unconcentrated, with ownership weighted toward private companies and local SOEs.

Chapter 5 compares SOE and non-SOE profit per unit of fixed assets (profitability) within manufacturing, based on regression analysis of enterprise-level data pooled from 2011–2013. While smaller SOEs match non-SOE profitability, profitability of the largest SOEs is one-third lower than large non-SOEs. Because of their sheer size, this drags down the aggregate profitability of SOE manufacturing. SOEs also pay out a higher-than-expected share of value added in wages and taxes – further evidence of SOEs' deviation from profit maximisation, even under competitive market conditions. This likely reflects the different distributional objectives between state and non-state owners.

The thesis argues that SOEs' broader contribution to GDP can be better illuminated using a value-added measure rather than profits alone. Poor performance on the value-added measure is limited to certain subsectors (most importantly, steel pressing).

The thesis concludes with implications for China's ongoing reforms and suggestions to guide future research.

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Chapter 1: State ownership and market efficiency

> We must unswervingly consolidate and develop the public economy, persist in the dominant position of public ownership, give full play to the leading role of the state-owned sector, and continuously increase its vitality, controlling force and influence.
>
> …
>
> We must actively and in an orderly manner promote market-oriented reform in width and in depth, greatly reducing the government's role in the direct allocation of resources, and promote resources allocation according to market rules, market prices and market competition, so as to maximize the benefits and optimize the efficiency.
>
> *Excerpts from:* Decision of the Central Committee of the Communist Party of China on Some Major Issues Concerning Comprehensively Deepening the Reform (the Decision), *Adopted at the Third Plenary Session of the 18th Central Committee of the Communist Party of China on November 12, 2013*

The Communist Party of China (the Party) recommitted itself in its 2013 *Decision* to 'hold the direction of reform towards the socialist market economy'. The 'socialist market economy', which had been officially adopted in 1993 (Zeng, 2012) contains two limbs. The 'socialist' limb is reflected by the Decision's commitment to consolidating the 'dominant position of public ownership'. The 'market' limb is reflected in the commitment to promote the market's role in resource allocation in the name of efficiency. The state-owned enterprise (SOE) is an entity that spans these two limbs. The SOE is ultimately owned by society (socialist), but unlike ministries or state agencies that produce public goods or services, it operates in a market context.

Foreign economists' accounts of China's sustained economic growth since 1978 emphasise the role of the market. Naughton's account of China's economy 'growing out of the plan' (1996) and Lardy's 'Markets over Mao' (2014) stress the role of the private sector in driving economic growth. By assumption the default producer in the neoclassical model is a private, profit-maximising firm. State intervention is an exception that is permitted in the case of market failure. SOEs are one direct instrument for public intervention. SOEs are found even in market economies (OECD, 2014), but they are the exception rather than the default.

In China it is state ownership rather than private ownership that is the historical default. The transition to a 'socialist market economy' began from an industrial economy that was almost exclusively state owned. Reform and opening up allowed private and foreign enterprises to compete in those areas where competition contribute to the Party's desired economic and social outcomes.

SOEs' reputation for efficiency is poor. In classical socialist economies, SOEs were political animals, with a 'soft budget constraint' (Kornai, 1986, 1992) that insulated them from the need to pursue profit or efficiency. Economic policymakers in United States, the United Kingdom and Australia arguably share an 'ideological preference for the private sector' (Quiggin, 1999). These economists, trained in neoclassical economic models, public ownership is immediately associated with inefficiency. At (second) best, SOEs may be tolerated to remedy some market failure elsewhere. When, in the wake of the Global Financial Crisis, the Obama administration effectively nationalised Chrysler and General Motors, this was a source of embarrassment for the administration's economists, who were relieved when the intervention worked.[1]

By contrast in China, the Party's commitment to state ownership is unabashed. General Secretary Xi Jinping frequently stresses the importance SOEs 'becoming stronger, doing better, and growing bigger' (Xinhua, 2017). Some of China's SOEs are indeed growing bigger. Between 2005 and 2014, the number of Chinese SOEs included on the Global Fortune 500 increased from 14 to 76 (Kwiatkowski & Augustynowicz 2015). By 2015, the 113 SOEs administered by China's central government, had, between them, established 8,515 branches in 150 countries and were then responsible for 70 per cent of China's overseas direct investment (Xinhua 2015).

Such differences in history and ideology create a situation where Chinese SOEs are frequently misunderstood and often subject to ideological suspicion. In describing China's economic model as one of 'state capitalism',[2] Bremmer asks whether this spells 'the end of the free market?' – hopefully not, he concludes, if the United States continues to 'leading by example in promoting free trade, foreign investment, transparency and open markets' (2009, p. 55). More recently, the Trump administration in the United States (US) sees state ownership in China as evidence of a 'state-led, trade-disruptive economic model' that it claims is fundamentally incompatible with the commitment to 'open, market-oriented policies' on which the US claims that membership of the World Trade Organization (WTO) is predicated (United States Government, 2018).

Yet the ideological objections to state ownership are rarely grounded in thorough, contemporary empirical analysis. Critics conceive of a large generic 'state sector' without distinguishing between the legitimate sector-specific roles that SOEs may play, particularly in those sectors in which free market competition is not sufficient to maximise social welfare.

---

[1] 'no one involved in the decision to rescue and restructure General Motors and Chrysler ever wanted to be in the position of bailing out failed companies or having the government own a majority stake in a major private company. We are both thrilled and relieved with the result: the automakers got back on their feet, which helped the recovery of the US economy.' (Goolsbee and Krueger, 2015, p. 22)

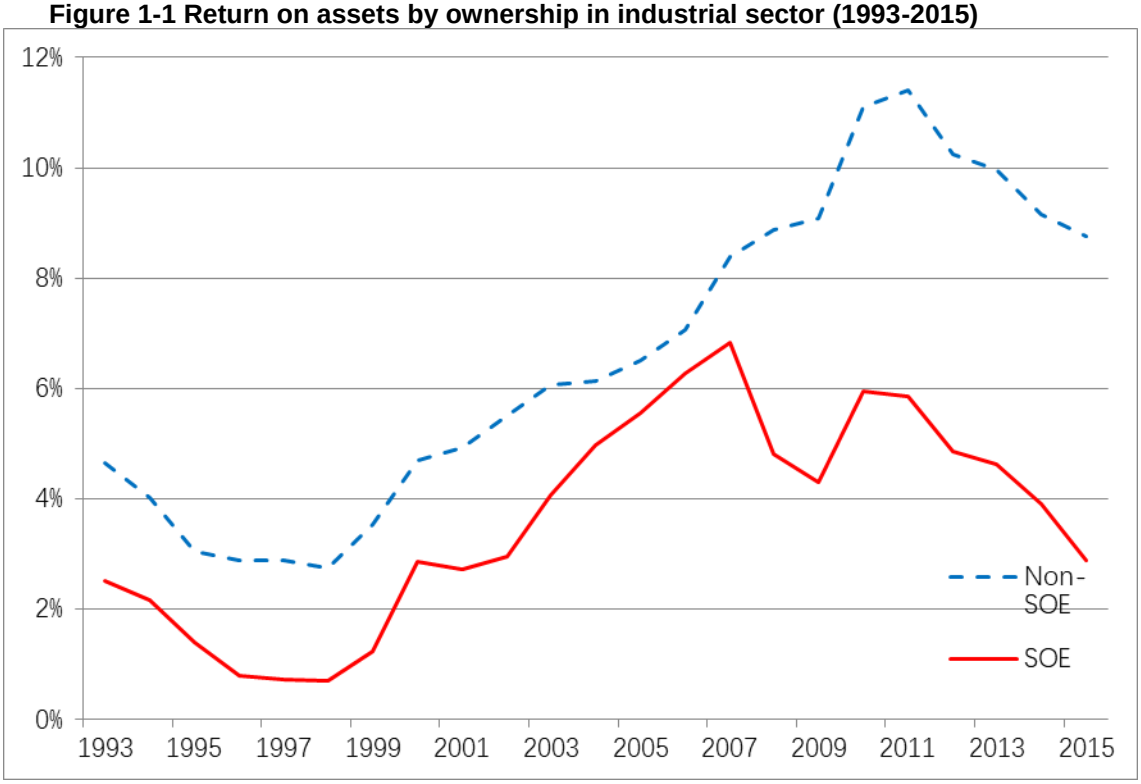
[2] McNally (2012, p. 744) proposes an alternative 'Sino-capitalist' model that combines 'top-down state development with bottom-up entrepreneurial private capital accumulation'.

SOEs' monopoly position is often asserted – and used to explain both high[3] and low[4] SOE profits. This thesis attempts to inform the broader debate by setting aside normative ideological questions, and instead providing a positivist account of the diverse and fragmented nature of state ownership in contemporary China. It considers the nature of SOEs in different sectors, before considering how to judge their performance.

1.1 Key questions for this thesis

To illustrate the poor performance of SOEs, scholars present Figure 1-1. It shows that the return on assets for SOEs in China's industrial sector is persistently lower relative to non-SOEs. Low profitability is evidence of allocative inefficiency in capital. As Lardy argues, 'there is a substantial misallocation of capital, which, if corrected, would allow China to sustain relatively rapid economic growth with a smaller share of resources devoted to investment' (2014, p. 125).

Figure 1-1 Return on assets by ownership in industrial sector (1993-2015)



Note Return on assets = profits before income tax divided by total assets. State-owned and state-holding companies, according to the concept to be defined in section 1.3

Source National Bureau of Statistics various years, adapted and updated from Lardy (2014, p. 98, 2016, p. 43, 2018, p. 332), Naughton (2017, fig. 3) and Song (2018, p. 355).

[3] 'SOEs have been retreating from some of the more competitive industries but remain concentrated in other industries with a state monopoly … The associated monopoly position arguably gives these SOEs competition advantage over private enterprises. Profits of SOEs continued to rise (they increased by 9.8% in 2009).' (World Trade Organization, 2010, pp. 55–56)

[4] 'despite the controlling status enjoyed by some SOEs in China's economy – largely due to their monopolistic market positions and barriers for private sector competitors – inefficiency and mismanagement of assets run rife' (U.S.-China Economic and Security Review Commission 2016, p.94).

This figure raises five related sets of questions,[5] which are used to structure this thesis. These questions relate to recognising changes to SOEs over time, the competitive conditions under which profit is most appropriate as a performance measure, the distribution of SOEs across the Chinese economy, the nature of market competition within industry, and finally the profitability of different SOEs within competitive parts of Chinese industry.

The first set of questions relates to comparisons of SOE performance across time. How has the role of the state in the economy changed during the reforms of a planned economy to a 'socialist market economy', and the opening up of China from a closed economy in 1978 to a globalised economy marked by China's accession to the WTO in 2001? Having commenced life in the planned economy as urban work units integrated within the state apparatus, what is the modern definition of 'SOE' and how does the state owner exercise its ownership rights? These are the questions to be explored in the remainder of this introductory chapter.

The second set of questions relates to the suitability of profit-based measures (such as return on assets) as a measure of SOE performance. A standard result of producer theory under assumptions of perfect competition is that profit-maximising behaviour of perfectly competitive firms leads to socially efficient outcomes. A corollary of this is that a departure from profit maximisation implies inefficiency. But what about sectors where profits are higher because of monopoly, natural resource rents, or the inherent uncertainty of economic development? And what if the state owner values social, political and developmental objectives beyond profit (Naughton, 2018, p. 378)? Of course, there may be inefficiency still from the state owner's failure to monitor its operations and the possibility that SOEs are used for the benefit of insiders rather than state. These questions are considered in Chapter 2.

Given the potential difference in objectives between different sectors, it is necessary consider the importance of state ownership in different sectors of the Chinese economy. After four decades of reform and opening up, where do SOEs remain dominant, and where has state ownership been replaced by private competitors? While the largest Chinese SOEs in electricity, oil, telecommunications and transport have achieved global prominence, to what extent are they representative of SOEs in general? How is state capital actually distributed amongst different state owners, and across different sectors? Are the sprawling corporate conglomerates that are characteristic of China's largest SOEs representative of SOEs in general? These empirical questions explored in Chapter 3 are important to judge how significant SOEs actually are in Chinese industry, and how representative industrial SOEs are of state ownership in general.

If profit is to be interpreted as a measure of return on capital (neither augmented by the existence of monopoly rents, nor dissipated by the pursuit of broader policy objectives), then a

[5] Lardy and Naughton both presented variations of this figure at the 2018 China Update held at the Australian National University on 20 July 2018. Professor Justin Lin questioned this figure, suggesting it was comparing apples and bananas.

comparison of profits between SOEs and non-SOEs is most meaningful in those sectors in which forms of ownership compete directly. Given this, it is necessary to identify not just those sectors in which SOEs remain dominant, but also the nature of market competition in those sectors. To what extent is Chinese industry competitive? The extent of market competition has previously been estimated in individual mining, manufacturing and utilities subsectors, drawing from China's National Bureau of Statistics' (NBS) Survey of Above-Scale Industrial enterprises. But to what extent does this understate the level of market concentration, given that economically-related members of the same large SOE conglomerates appear in the survey as legally-distinct survey respondents? Do SOEs in concentrated industries in fact seek to parlay market concentration into higher profits, as would a profit maximising firm? These questions are explored in Chapter 4.

Focusing just on competitive manufacturing sectors, how do SOEs then perform on a direct profit comparison? Does the large gap between SOE and non-SOE aggregate profitability still hold at the firm level, and after using regression analysis to control for otherwise confounding sectoral and regional fixed effects? Does the profitability gap hold for small SOEs under the most competitive conditions? Do "bigger" SOEs have better or worse performance, and does this dominate the overall results? Given the potentially broader interests of a state owner compared to a private owner, is there any evidence of 'missing' SOE profits being captured in a broader measure of value added that accounts also for wages and taxes? And to what extent is poor SOE performance as measured in this way a sector-specific phenomenon? These are empirical questions that are considered in Chapter 5, using the 2011-2013 waves of the Above-Scale Industrial Enterprise survey.

Following the empirical observations in the preceding chapter, the final chapter offers some concluding remarks on the original question – what is the nature and performance of SOEs in China's economy today? What does this imply for future reform or the study of the Chinese economy?

1.2 A brief history of China's state-owned enterprises[6]

China's modern SOEs emerged from a dynamic historical process that began with the deliberate monopolisation of industry by the State. This section provides a brief account of the pre-reform conditions of the Chinese economy, in which the state monopolised the industrial sector as an explicit development policy. It then briefly outlines how SOEs emerged from the

[6] This section is derived in part from Hubbard and Williams (2017), copyright Inderscience Publishers: http://dx.doi.org/10.1504/IJPP.2017.10006452. The published paper was co-authored by the author with Patrick Williams, whose contribution focused on the history and evolution of Chinese policy toward SOEs. For a more expansive history of SOEs, readers are referred to Garnaut, Song, Tenev and Yao (2005), Lardy (1998, chap. 2, 2014, chap. 2), Lin (2012, chap. 5), Naughton (2007b, chap. 13) and Wu (2005, chap. 4).

work units of the central plan, and how in many sectors the emergence of non-state firms created competition for state enterprises. The purpose is to understand the historical context in which today's SOEs emerged and explain why state ownership is the default ownership mode in sectors with less competition.

1.2.1 A planned industrial state monopoly economy (1949–1978)

Prior to the successful Communist Revolution in 1949, China's Nationalist regime had governed China according to a 'controlled economy' policy. This entailed state ownership and control of large-scale investment in important industries such as finance, mining and electricity (Paauw, 1957, p. 216). Although China was an agricultural economy, poorer on a per capita basis than most other parts of Asia or Africa (Maddison, 2013), the Nationalist government had developed a few industrialised urban centres (Tamura, Menton and Cohen, 1997). It controlled the flow of credit through four government banks, and government shareholdings in the otherwise ostensibly private banking system (Paauw, 1957, p. 218). It also controlled, either directly or through its officials, one third of industrial production in the Republic of China (Chen, 1996, pp. 26–27). The conclusion of the Second World War resulted in the confiscation and nationalisation of property previously owned by the Japanese and their collaborators, pushing the state share of industrial capital to almost two thirds by the late 1940s (Naughton, 2007b, p. 49).

At the founding of the People's Republic of China in 1949, the new Communist government assumed control of those enterprises previously owned by the Nationalists (Naughton, 2007b, p. 49). Some of today's central SOEs relating to railway signals, engineering and construction can trace their origins loosely to this period. The forerunners of China Minmetals Corporation,[7] the China National Salt Industry Corporation and the China National Silk Import and Export Corporation were also established prior to the Communist revolution (SASAC, 2016, p. 305,469,617).

The *Communist Manifesto* (Marx and Engels, 1848) was explicit in its policy toward private property:

> You are horrified at our intending to do away with private property. But in your existing society, private property is already done away with for nine-tenths of the population; its existence for the few is solely due to its non-existence in the hands of those nine-tenths. …
>
> In one word, you reproach us with intending to do away with your property. Precisely so; that is just what we intend.

[7] Established in 1950 as China National Metals & Minerals Import & Export Corporation and renamed in 2004 (Huang and Zhu, 2016, pp. 76–77).

Yet China's Communist Party did not immediately attempt to abolish it. Given China's immediate challenges, Party Chairman Mao Zedong regarded foreign imperialists to be a greater threat than domestic capitalists (Wu, 2005, p. 31). So capitalists were briefly co-opted and sheltered from foreign competition (Naughton, 2007b, pp. 66–67; Lin, 2012, pp. 78–79). The 1952 Constitution of the People's Republic of China still recognised the rights to inherit and use private property, subject to the public interest (National People's Congress, 1954). Complete nationalisation was not expected to come for another fifteen years (Wu, 2005, p. 32)

But China's entry into the Korean War in October 1950, against what it perceived as the imperialist threat of the United States (Hao and Zhai, 1990), demanded a faster pace of industrialisation (Wu, 2005, pp. 32–33,35; Naughton, 2007b, p. 64). Many newly independent countries in the decades following the Second World War sought to establish an industrial base through the rapid accumulation of physical capital (Felix, 1989; Lin, 2012, p. 104). The Soviet Union provided the model for China (Ishikawa, 1983; Lin, 2012, p. 70). Following this economic model, and backed by Soviet expertise, China established its State Planning Commission in 1952 and launched the first five-year plan in 1953. The Plan channelled resources to almost 150 new state enterprises (Lieberthal, 1995, p. 93), some of which, such as China First Heavy Industries and Harbin Electric Corporation, survive today as central SOEs (SASAC, 2016, pp. 208, 222). Private finance was abolished, and pre-existing financial institutions were amalgamated into the People's Bank of China, which, from 1953 until 1978, was a 'mono-bank', performing the basic function of keeping the financial accounts of the economic plan (Lardy, 1998, p. 61; Wu, 2005, p. 218; Naughton, 2007b, pp. 454–455).

The Plan attempted major changes to China's industrial structure – yet its initial practical success was overtaken by ideology (Naughton, 2007b, pp. 69–71). In a 1958 report later praised by Mao, the Minister of Metallurgical Industry estimated that China's steel production could catch up with Britain's within ten years, and the US' ten years after that (Shen and Xia, 2011, p. 864). This was from an almost negligible base, in 1949, of less than one megaton (Feng, 1995, p. 220). With Soviet assistance, steel production had already reached five megatons by 1958 and almost 19 megatons in 1960, but production collapsed back to less than nine megatons in 1961 (Feng, 1995, p. 220) as the Great Leap Forward ended in a catastrophic famine (Naughton, 2007b, pp. 70–72; Lardy, 2014, p. 39).

The heavy industry push had defied the comparative advantage of China's agrarian and labour-dense economy (Lin, 2012, p. 104). Nine out of ten Chinese still lived as rural peasants on millions of smallholding farms. These farms, which for centuries had been owned either by families or petty landlords, were collectivised on a largely 'voluntary' basis into 753,000 cooperatives by 1957. After 1958 they were consolidated into 24,000 communes (Lin, 1990, p. 1234; Wu, 2005, p. 34). State policy was explicitly designed to channel resources from rural agriculture to urban industry (Naughton, 2007b, p. 115).

Suppression of market prices was one method of controlling the flow of resources to preferred beneficiaries under the plan (Lin, 2012, pp. 76–78; Lardy, 2014, p. 12). The state acted as a single buyer in agricultural markets, which allowed it to depress prices for rural areas, and transfer the surplus to urban units (Stone, 1988). High state-industry profits that resulted from distorted prices, rather than taxes, formed the bulk of the state's budget revenue, which was largely re-invested back into industry (Naughton, 2007b, p. 60). This required formal division of rural peasants and urban workers into work units (*danwei*) (Lieberthal, 1995, pp. 108–109). These are the forerunners of China's modern SOEs.

The work unit defined not just the production possibilities of the industrial economy, but also the consumption choices, social services from birth to death, social identities and political engagement of urban Chinese (Koppell, 2007, p. 258; Naughton, 2007b, p. 117). The management of the work unit was appointed by the state, and tasked with fulfilling the obligations of the Plan (Au, 2011, p. 465). Employees' representative meetings were also created to allow the exercise of 'enterprise democracy' (Hua, Miesing and Li, 2006, p. 417). Workers received exhortation rather than material incentives to work harder (Naughton, 2007b, p. 69).

The Plan was not monolithic (Naughton, 2007b, p. 66). China's geographic size, large population, low industrialisation, and weak central administrative capacity meant the layout of industry and its administration could not be centralised as completely as in smaller Communist countries. Regions were divided into relatively self-sufficient economic units (Donnithorne, 1972; Qian and Xu, 1993, p. 544). The provincial administrative level would control larger-scale enterprises, such as those engaged in steel production (Lin, 2012, pp. 174–175). The county government below it controlled the enterprises assigned (for example, the finance bureau and textile industry), and oversaw township governments within its territory.

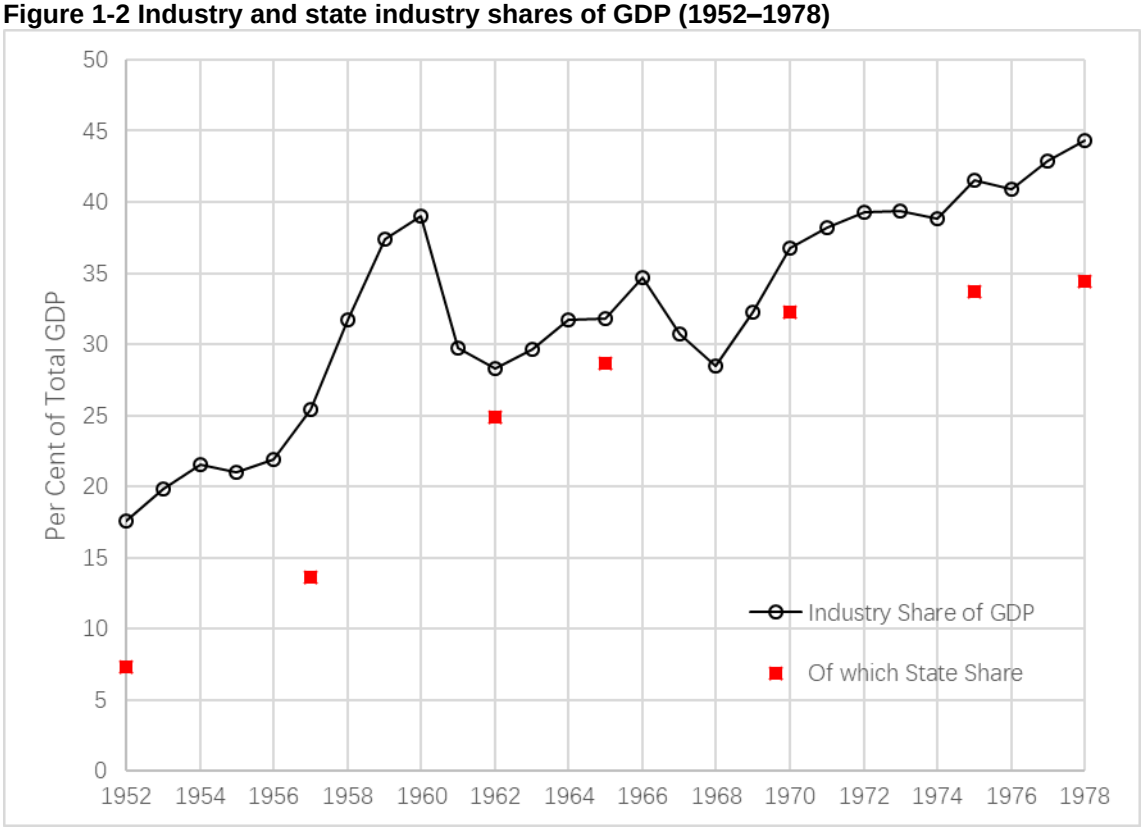
Execution of the plan prioritised politics over efficiency. Officials appointed managers to work units, assigned labour and administered cash flows. Managers within the work unit had no say over investment, production, procurement, recruitment or marketing (Lin, 2012, p. 80). While there was no need to engage with the market, an astute manager could negotiate bureaucratically to access scarce resources (Naughton, 1992a; Wu, 2005, pp. 141–142). The reliance on political favours and organisational discipline to induce effort removed incentives to reduce waste or seek to improve production methods (Kornai, 1992, pp. 121–127). Combined with the impossibility of bankruptcy, this created the 'soft budget constraint syndrome' that was a worldwide feature of the socialist economic system as coined and extensively described by Kornai (1986, 1992; 2003).

To ameliorate some of these problems, various schemes of administrative decentralisation were adopted throughout the 1960s and 1970s to shift responsibility for planning and production

to lower administrative levels (Wu, 2005, p. 53). But this generated new problems which triggered periodic recentralisation (Lin, 2012, p. 175). There was no room for experiments with private ownership. The 1975 revision to the Constitution removed recognition of private property and declared the inviolability of '[s]ocialist public property' (National People's Congress, 1975).

The monopolisation of Chinese industry by the state, and the forced transfer of resources from rural agriculture to urban work units was successful, in its own terms, at diverting resources to industry (Lin, 2012, pp. 82–85). Figure 1-2 shows that from the beginning of statistical collection in 1952 until the beginning of China's economic reforms in 1978, the industrial share of GDP more than doubled, and that most of this came from state units. Non-state production in the 1970s did not refer to 'private' firms, but referred to those collectively owned firms under the jurisdiction of local governments (Lardy, 2014, p. 11) or the People's Liberation Army.

Figure 1-2 Industry and state industry shares of GDP (1952–1978)



Source Author's calculation based on NBS (1999, secs 3–2, 13–3).

1.2.2 Enterprise reform and opening up to non-state competition (1978–present)

Despite the growing importance of industry in the economy, national income growth fell short of the economic progress being made elsewhere in Asia (Naughton, 2007b, p. 59). The average per capita growth rate from the establishment of the People's Republic in 1949 to the

death of Party Chairman Mao Zedong in 1976 was just 2.5 per cent per year. China lagged well behind the faster growing economies in East Asia (Lin, 2012, p. 153). Average income in 1976 was 13 times higher than China's in Japan, more than four times higher in South Korea and Taiwan, and two and a half times higher in the Philippines (Lin, 2012, p. 154; Maddison, 2013).

The ascension of Deng Xiaoping as China's paramount leader after the death of Mao in 1976 allowed for the relaxation of ideological control, and the pursuit of a more pragmatic economic policy (Naughton, 2007b, p. 79; Vogel, 2011, pp. 387–388; Lin, 2012, p. 153). The 1978 Constitution (National People's Congress, 1978) restated the 1975 provisions with respect to property, but the Third Plenary Session of the 11th Central Committee in 1978 launched a three year program of economic 'readjustment' designed to boost the production of agricultural and consumer goods, and overcome bottlenecks in transport and industry (George, Gullo and Stein, 1981). The introduction of the household responsibility system, beginning in 1978 as a local experiment in Xiaogang village, Anhui province, had by 1984 effectively reversed the 1950s' collectivisation of agriculture (Lieberthal, 1995, pp. 147–148; Lin, 2012, pp. 155–160).

In the industrial sector, the focus was on improving the efficiency of work units. A policy of opening up enabled China to seek foreign technical assistance in bringing modern production technology to mainland China (Zheng, 1980). The flagship project for this was the Baoshan steel plant, a project that was initiated on 23 December 1978 (SASAC, 2016, p. 238) and built in the 1980s under the auspices of the central government with assistance from Japan's Nippon Steel (Hogan, 1999, p. 4). The focus on quality steel using the new milling technology required the construction of a new harbour to facilitate the import of high-grade iron ore from Australia and Brazil (Zheng, 1980; Tcha and Wright, 1999). It remained China's largest and most modern steel plant until the 1990s.[8]

Managers in work units began to receive some autonomy from plan directives. The readjustment plan limited the mandatory elements of the plan to fewer economic variables, recasting other items as projected targets instead (Ishikawa, 1983, p. 653). After meeting the plan targets, some work units were allowed to produce and market goods according to market demand and retain some of the profits for welfare expenses, bonuses and technical improvements. This was authorised on an experimental basis in October 1978 (Wu, 2005, p. 60). By the end of 1980 almost six thousand work units were participating, retaining around ten per cent of profits (Aram and Wang, 1991, p. 32). This was the first step in creating stand-alone 'enterprises' that were separate from the state bureaucracy.

[8] By 2015, Baosteel had become the fifth largest producer of steel in the world by tonnage (World Steel Association 2015b). Although it is the largest steel producing central SOE, steel remained primarily a provincial concern. China's largest steel producer (and 43rd largest company by revenue in 2013, see Table 3-6), Hesteel Group, remains under the jurisdiction of Hebei Province (2017).

Increased managerial autonomy was to be incentivised with a ‘managerial responsibility system’ that began to realign managerial behaviour away from plan fulfilment toward profitability (Naughton, 2007b, p. 95; Lin, 2012, p. 177). At the start of the reform period the secretary of the work unit’s party committee exercised almost complete control over production decisions as well as political affairs of the enterprise. With the work unit now expected to respond both to market and state demands, provisional regulations were promulgated in 1982 to create a division of labour between the party secretary, who would specialise in political affairs, and the factory manager, who would make the day to day production decisions. The system was trialled in six cities from May 1984 and applied universally in 1986 (Chamberlain, 1987; Lee, 1990). This encouraged managers to seek above-target growth, indirectly increasing revenue for the state.

Through these reforms the work unit, which had been integral part of state administration, had begun its evolution into a separate enterprise, marked by an ownership relation with the state. This was most easily done by the wholesale conversion of industrial bureaux, and sometimes entire state ministries, into SOEs. For example, the China National Petrochemical Corporation (Sinopec) was created in 1983 from the Ministry of the Petrochemical Industry, which had monopolised downstream oil production. Its twin, the China National Petroleum Corporation (PetroChina) was likewise established in 1988 from the Ministry of the Petroleum Industry – which had monopolised upstream domestic production (Wu, 2005, pp. 156–157).

These gradual but dramatic changes in the Chinese economy were encapsulated by the term ‘growing out of the Plan’ (Naughton, 1996, p. 93). First in agriculture and then in industry, non-state production began to re-emerge with the relaxation of bans on private enterprise (Wu, 2005, pp. 181–186). State industry began to be ‘de-monopolised’ as the state ceased enforcing the strict discipline of the plan (Naughton, 1992b, p. 14). Limited private property rights began to re-emerge (Putterman, 1995, pp. 1051–1052), with the right ‘to own lawfully earned income, savings, houses and other lawful property’ and to inherit property re-recognised by the 1982 Constitution (National People’s Congress, 1982).

New entrants were not part of the state monopoly, but nor were they strictly ‘private’. Entrepreneurship occurred in collective ‘township and village enterprises’ (TVEs). These TVEs were local factories (Naughton, 2007b, p. 90) registered as collectives or cooperatives. But many were *de facto* private enterprises that were effectively owned or leased by private entrepreneurs. They wore a ‘red hat’ in order to receive the backing of local government officials and to escape the political harassment still associated with private enterprise (Garnaut and Song, 2004). It was not until 1998 that the ‘red hatted’ TVEs were finally ordered to privatise (Garnaut and Song, 2004; Naughton, 2007b, p. 287).

Unlike the urban work units, new non-state entrants were freed from the 'policy burdens' of providing education, housing, healthcare, pensions and other living allowances to current and retired workers (Lin and Tan, 1999, p. 429). With the advantage of being able to employ wage labour rather than provide jobs for life, they proved to be more nimble profit seekers in the market environment. They recruited cheap rural labour (Lardy, 2014, p. 17) and chased profits in those sectors where the cost of entry was lowest (Naughton, 2007b, p. 276).

Some SOEs had countervailing advantages. During the 1980s a 'dual track' pricing system was implemented with 'plan prices' and 'market prices' running in tandem. This created opportunities for arbitrage and corruption for those SOEs that could buy at the typically lower plan price and sell at the market price (Wu, 2005, pp. 68–71; Naughton, 2007b, pp. 91–92). By the early 2000s these opportunities dissipated as almost all product-market prices became competitively determined (Lardy, 2014, pp. 13–14).

A 'dual track' for pricing capital between SOEs and non-SOEs has also existed since 1983 when fiscal appropriations were replaced by bank loans as the primary source of capital for SOEs (Lin, 2012, p. 193; Lardy, 2014, pp. 21–22). Non-SOEs needed to depend either on investment of their retained earnings, or seek access to credit through informal markets at much higher rates (Lau et al. 2000). Some began to raise capital outside the state banking system. In September 1984, the Tianqiao Department Store Company of Beijing was the first new enterprise to raise money by issuing debt stock outside the state banking system (Mookerjee and Yu, 1995, p. 24). The state began to mimic some of the corporate forms of the non-state sector. In 1986 a small group of state enterprises were given permission to issue stock, following the example of Tianqiao. Although stocks had been traded unofficially and in regulated over-the-counter markets, the official Shanghai Security Exchange began operation in December 1990, followed by the Shenzhen Securities Exchange in 1991 (Mookerjee and Yu, 1995, p. 24).

The Third Plenary Session of the 14th Central Committee meeting in November 1993 declared the establishment of a 'socialist market economy' (Zeng, 2012). One of its key decisions was broadly to adopt the corporate model for the state economy, completing the transition of work units from part of the government administration into stand-alone enterprises that were connected to the state via a property relationship (Xi, 2005, p. 95). The state-owned enterprise was born.

Those SOEs in sectors facing private competitors began losing the state money (Naughton, 2007b, pp. 105–106). Almost three quarters of local SOEs were loss making by 1995, compared to around a quarter of central SOEs (Garnaut, Song and Yao, 2006, p. 38). Faced with this problem, the central government adopted a policy in 1995 of 'keeping the large and letting the small go', proving permission for the closure or privatisation of loss-making SOEs and

retrenchment of state employees (Wu, 2005, pp. 192–194; Naughton, 2007b, pp. 301–302; Zhang and Freestone, 2013; Lardy, 2014, p. 18).

Over the first two decades of the reform program, the Chinese government provided direct budget subsidies to maintain the viability of loss-making SOEs (Bhala, 2000). But China's aspiration to join the WTO meant aligning to external standards and driving competition by exposing Chinese producers to world prices (Naughton, 2007b, pp. 104–105). The WTO's *Agreement on Subsidies and Countervailing Measures* prohibited direct subsidies to promote exports or favour domestic goods, whether provided by the direct transfer of funds or through tax credits. Explicit undertakings to remove subsidies, including budget support to unprofitable SOEs, was a further condition of China's accession protocol that was concluded during bilateral negotiations with the US in 1999 that finally opened the way for China's WTO accession (World Trade Organization, 2001; Bajona and Chu, 2010).

But the protocol did not require the removal of indirect subsidies provided through soft loans in the banking system. The use of subsidised bank credit to provide ongoing financial support to SOEs remains a widely noted feature of the Chinese economic system. Based on Liu and Zhou's (2011, p. 60) estimates of the real interest rate[9] of above-scale industrial firms from 2001-2007, the Unirule Institute of Economics (2011, p. 46; Haley and Haley, 2013, p. 34) assumes a real interest rate of 1.6 per cent for SOEs, and 4.7 per cent for non-SOE borrowers. Estimating the interest that would be payable were SOEs to pay the non-SOE rate, the Unirule study attributes a 454 billion RMB interest rate subsidy to industrial SOEs for 2009. This was almost half of the 929 billion RMB profits reported by industrial SOEs that year (Unirule Institute of Economics, 2011, p. 52).[10]

Following the example of Japanese and Korean industrial policies, Nolan (2001) describes the Chinese government's early interest in forming large industry groups as 'national champions'. These would be of sufficient scale to compete internationally and could be used to justify non-competitive behaviour between firms in the domestic market. Large SOEs were given an opportunity to become larger still – by creating subsidiary corporations to which their best performing assets were transferred, and then floating those subsidiaries on the domestic and international share markets (Zhang, 2004).

By the early 2000s the formal barriers to private sector competition in most industrial sectors had been removed. The 2004 constitutional revision finally rehabilitated the citizen's lawful private property to equal status with public property – it too was now 'inviolable'

[9] Calculated as total financial costs, divided by total liabilities

[10] The 2016 IMF Staff Report on China (Kang *et al.*, 2016, p. 46) follows this estimate, and further remarks that the financing costs for listed SOEs are 40-50 basis points below the official benchmark lending rate, a figure misinterpreted in the US-China Economic and Security Review Commission's (2016, p. 104) as being 40-50 *percent* below the benchmark lending rate.

(Article 13). In 2005, the State Council removed formal barriers to private investment in most areas (Rong, 2013). By this stage the initial round of SOE reforms and retrenchments had run its course, and modern forms of corporate governance had been widely adopted (Naughton, 2018, pp. 376–377).

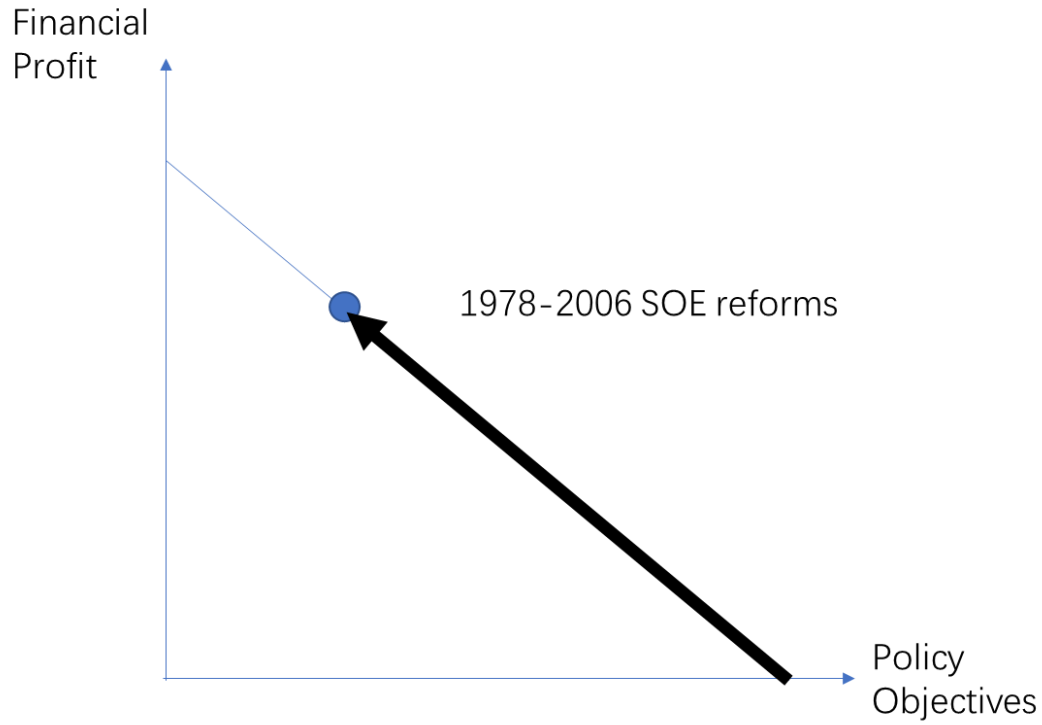
The nature of the Chinese economy had fundamentally shifted. While China's economic model prior to 1978 had promoted industrialisation, the economic development that came with reform and opening up grew the services sector that had been repressed under the Plan (Naughton, 2007b, p. 80). Between 1952 and 1978, the services share of GDP hovered around one quarter (National Bureau of Statistics of China, 1999, secs 3–2). The share began growing in the 1990s, finally surpassing half of GDP by 2015 (National Bureau of Statistics of China, 2016, secs 3–7).

The evolution from work units in monopolised markets pursuing political and developmental objectives of the state to corporate SOEs pursuing financial profits in competitive markets can be illustrated, in stylised form, using a basic production possibility frontier chart. Figure 1-3 shows the potential for trade-offs between profit objectives on the vertical axis, and political, social or developmental (policy) objectives on the horizontal axis.[11] The top-left corner solution – in which the state owner seeks to maximise financial profit – is equivalent to the standard profit-maximisation objective of private firms.

The shifting objectives of state-ownership, from policy objectives (fulfilling plan directives and providing social welfare services) to the pursuit of financial profit can be represented as a shift in objective up and to the left of the curve. The more financial profit is emphasised as the goal of SOEs, the less affordable become the non-profit policy objectives

[11] This follows the OECD guidelines on corporate governance of state-owned enterprises (2015, p. 15), which define the public policy objectives of an SOE as those specific requirements – other than the maximisation of profits – placed on an SOE to benefit the general public. The production possibility frontier has been represented as two dimensional for the purposes of simplicity. In reality the trade-offs for Chinese state-owned enterprises are multi-dimensional. Even if the development policy objectives of the State could be easily specified, there is a further explicitly political dimension that relates to the role of the Party that would need to be considered. This accounts for the fact that not only are the "bosses" of SOEs business managers, but in many cases they are also politicians for whom a post at an SOE is simply a step on a broader career path (Brødsgaard et al., 2017).

Figure 1-3 Changing objectives of SOEs (1978–2006)



But policymakers did not intend to leave the development of the Chinese economy entirely to market competition. The Chairman of the State-owned Assets Supervision and Administration Commission of the State Council (Central SASAC) in 2006 designated armaments, power generation and distribution, oil and petrochemicals, telecommunications, coal, civil aviation and shipping, as industries in which the state should maintain a majority shareholding (Zhao, 2006; Lardy, 2014, p. 54). In other 'basic and pillar' industries (machinery, automobiles, information technology, construction, steel, base metals, chemicals, land surveying, research and development) central SOEs would remain 'heavyweights' (Zhao, 2006).

But the 2008 global financial crisis (GFC) – judged by some as a failure of the neoliberal economy model – also marked a turning point back toward political and developmental objectives for SOEs. Naughton (2017, p. 289) contrasts the old 'policy burdens' with four new developmental 'missions' for SOEs: upgrading of Chinese technical capacity (for example, the China 2025 goals), promoting China's international economic power and influence (through its national champions), maintaining of macroeconomic stability, and leading structural reform by decommissioning excess capacity. While not a regression to the original *work unit*, this can be conceptualised as a move back down the production possibility frontier.

1.3 Contemporary classification of state-owned enterprise[12]

Although SOEs are formally owned by 'the people as a whole', the exercise of ownership rights was vested in the relevant industrial ministry until the late 1990s, with limited financial oversight from the State Asset Management Bureau (Naughton, 2003). This system was further fragmented in 1998 with rights to oversee various aspects of SOE management scattered across various state organs – including the State Economic and Trade Commission, the Central Work Committee for Large Enterprises, and sections of the Ministry of Finance and the Ministry of Labour and Social Security (Ho and Young, 2013; Wang, Zhen and Zhang, 2015).

Central SASAC was created in 2003 was meant to re-integrate ownership rights into new specialised ownership agencies responsible for the supervision and management of state-owned assets of most non-financial enterprises (Naughton, 2007a; Unirule Institute of Economics, 2011, pp. 161–162). Responsibility for most local SOEs was passed to newly established SASAC branches down to the provincial level and below.

Different vertical levels of the state may have different political standing and geographic responsibilities. All SOEs and many older private firms also have a defined administrative relationship (*lishu guanxi*), which determines not just the administrative level at which government approvals are necessary, but also the point through which the firm may be able to extract resources from the state through subsidies, access to finance or favourable tax treatment (Harris, Hashimzade and Ding, 2016). Depending on their position in the hierarchy, SOE managers have a corresponding political status and social influence (Li, 2012; Suo, 2014). For example, a central agency's firm may be able to ignore local environmental regulations, even when the local regulator is effective at constraining private firms within its jurisdiction (Ahlers and Shen, 2017).

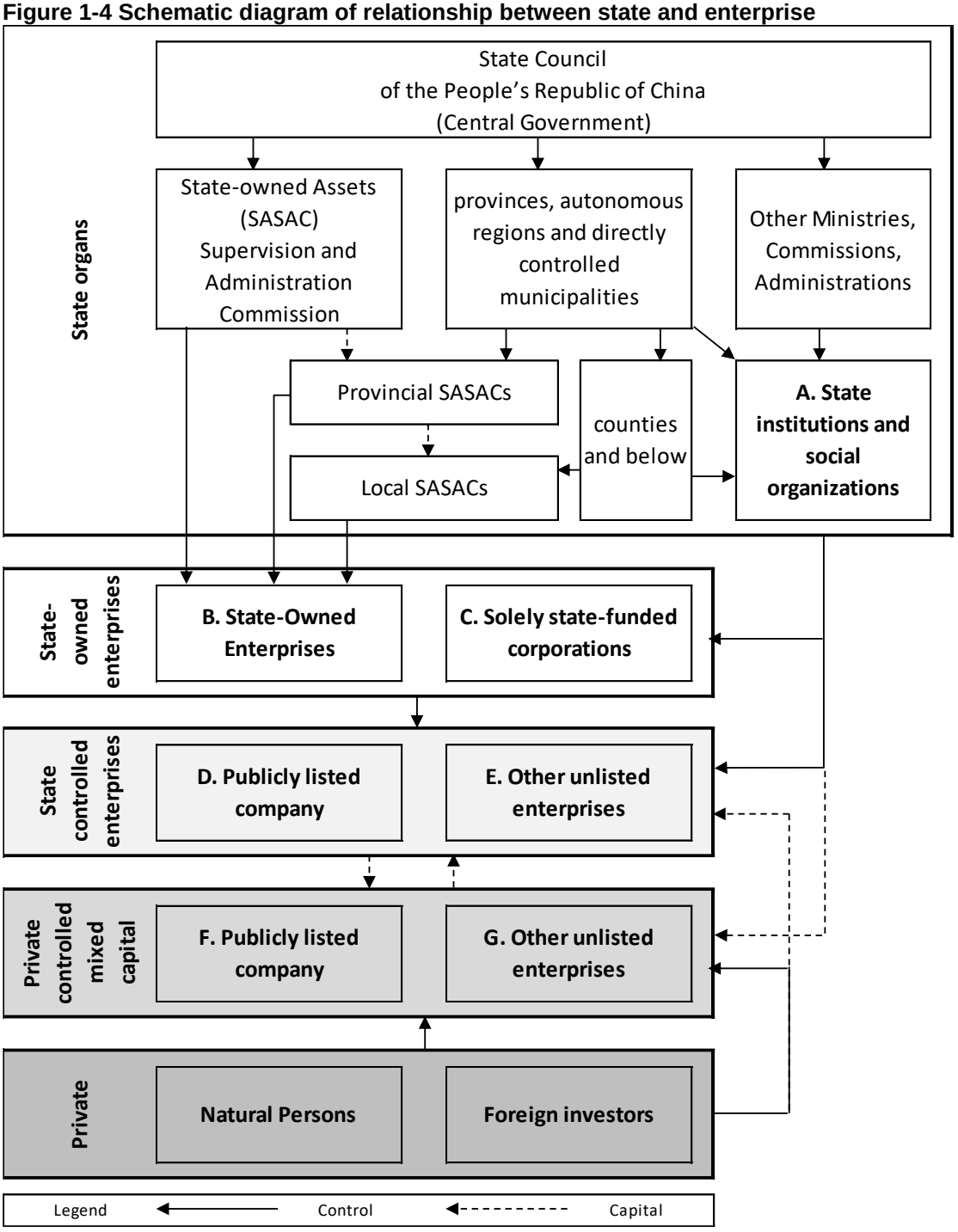
Central SASAC controls the most politically significant central SOEs. Their top managers are integrated with the Party's political leadership system through the Central Organisation Department of the Communist Party, which acts through central SASAC to appoint the leadership from the central *nomenklatura* (Naughton, 2007b, p. 61), conferring on them a political rank equivalent to a vice-minister (Brødsgaard, 2012; Lardy, 2014, p. 52). SOE leaders outside the 53 main SOEs are appointed at bureau director level, equivalent to the mayor of a large city, by a separate office within SASAC office, subject to Organization Department veto (Yang, Wang and Nie, 2013).

[12] This section is based in part on EABER Working Paper (Hubbard, 2015a), in part from Hubbard (2016), copyright Taylor & Francis, available online: http://dx.doi.org/10.1080/17538963.2016.1138695, and in part from my co-authored paper with Brødsgaard et al (2017)

SOEs controlled by local SASAC bureaux and agencies lack the national political connections or policy significance of ‘national champions’. Appointments are controlled by the local party apparatus rather than the central government, and so the political status of these SOE leaders is inferior to that of central SOE heads. But the local state and party apparatus may have its own interests in its SOEs, ranging from local development priorities (Oi, 1995) and the maintenance of social stability (Wang, 2014), to the opportunities they provide to local officials for personal enrichment through corruption (Pei, 2016).

The profusion of corporate structures means that, in terms of numbers, most SOEs are only indirectly controlled by the state, through chains of other SOEs. In many cases (most notably publicly-listed companies) these are through mixed ownership arrangements that combine outside private or foreign capital. This concept of ‘mixed capital’ also encourages the state to take non-controlling shares in otherwise private enterprises. Figure 1-4 illustrates the different ways in which state-controlled companies might be related to various state organs.

Figure 1-4 Schematic diagram of relationship between state and enterprise



Source Author's diagram (Brødsgaard et al., 2017, fig. 2)

These can be captured in statistical data according to separate concepts of official registration, control or capital shares. These are briefly described and compared below. For the remainder of the thesis the broader 'control' concept is used.

1.3.1 Narrow – Official registration and state equity

All industrial and commercial enterprises in China must be registered according to the 2006 *Provisions for the Classification of Types of Enterprise Registration*. These provisions are

jointly issued by the National Statistics Bureau and the State Administration for Industry and Commerce. They include 18 major classifications, and ten sub-classifications. These are grouped broadly into ‘domestic capital enterprises’, ‘Hong Kong, Macau and Taiwan (HMT) capital enterprises’ and ‘foreign capital enterprises’ as shown in Table 1-1.

Table 1-1 Firm registration classifications

Domestically-invested enterprises
State-owned enterprise
Collective enterprise
Share cooperative enterprise
Joint venture
State-owned joint venture
Collective joint venture
State-owned and collective joint venture
Other joint venture
Limited liability corporation (LLC)
Wholly state-owned LLC
Other LLC
Company limited by shares
Private enterprise
Private wholly-owned enterprise
Private partnership
Private limited liability company
Private company limited by shares
Other enterprise
Hong Kong, Macao and Taiwan (HMT)-invested enterprises
Equity joint venture (HMT)
Cooperative joint venture (HMT)
Wholly HMT-owned enterprise
HMT-invested company limited by shares
Other HMT-invested enterprise
Foreign-invested enterprises
Sino-foreign equity joint venture
Sino-foreign cooperative joint venture
Wholly foreign-owned enterprise
Foreign-invested company limited by shares
Other foreign-invested enterprise

Source (National Bureau of Statistics of China and State Administration for Industry and Commerce, 2011)

A ‘State-Owned Enterprise’ defined strictly according to these provisions is a wholly state-owned, non-corporate entity that is registered as such according to the *Administration of the Registration of Enterprise Legal Persons*. Effectively, this includes enterprises that are directly administered by the SASAC at the central or provincial levels (box B in Figure 1-4). However, it does not include their wholly or partially owned corporate subsidiaries, nor any publicly listed subsidiaries.

A limited liability corporation (LLC) is registered in accordance with the *Regulations for the Administration of Company Registration* and has between two and fifty shareholders. There are wholly state-owned LLCs, in which the only investors are SOEs (in the strict terms defined above) or agencies, and other LLCs – which may include any degree of ownership by the state less than 100 per cent. A company limited by shares (a limited liability company) is also registered according to the *Regulations for the Administration of Company Registration* and may have any number of shareholders.

The provisions define 'private enterprise' to include a 'private wholly-owned enterprise', a 'private partnership', a 'private limited liability company' and a 'private company limited by shares'. The basis of this group is that the investors are natural persons (the minimum number of whom differs according to the sub-classification) or, in case of a private LLC or private shareholding company, that the enterprise is controlled by a single natural person.

The limitations of definitions above for SOEs and wholly-state-owned LLCs become stark when considering that many SOEs are part of sprawling corporate conglomerates. Any publicly listed company that is controlled by an SOE would not count as an SOE under this strict definition, nor would SOE-private joint ventures or partnerships with foreign investors. Therefore, any analysis undertaken based on official registration categories would understate the degree of actual state control in the economy (Scissors, 2016).

A related method of classifying SOEs is according to the nature of their equity contribution. The NBS industrial survey provides data on the paid-in capital of enterprises, which is further divided into five subcategories – state capital, collective capital, legal-person capital, natural person capital, HMT capital and foreign capital. State capital includes direct capital contribution from government departments, institutions and public-sector units (National Bureau of Statistics of China, 2012, p. 87).

Classification on these grounds also fails to capture SOEs that are indirectly controlled by the state, if they are held through 'legal person capital' – for example, state-owned LLCs or other state-owned corporations – rather than a state agency.

1.3.2 Broad – State-owned and state-controlled companies

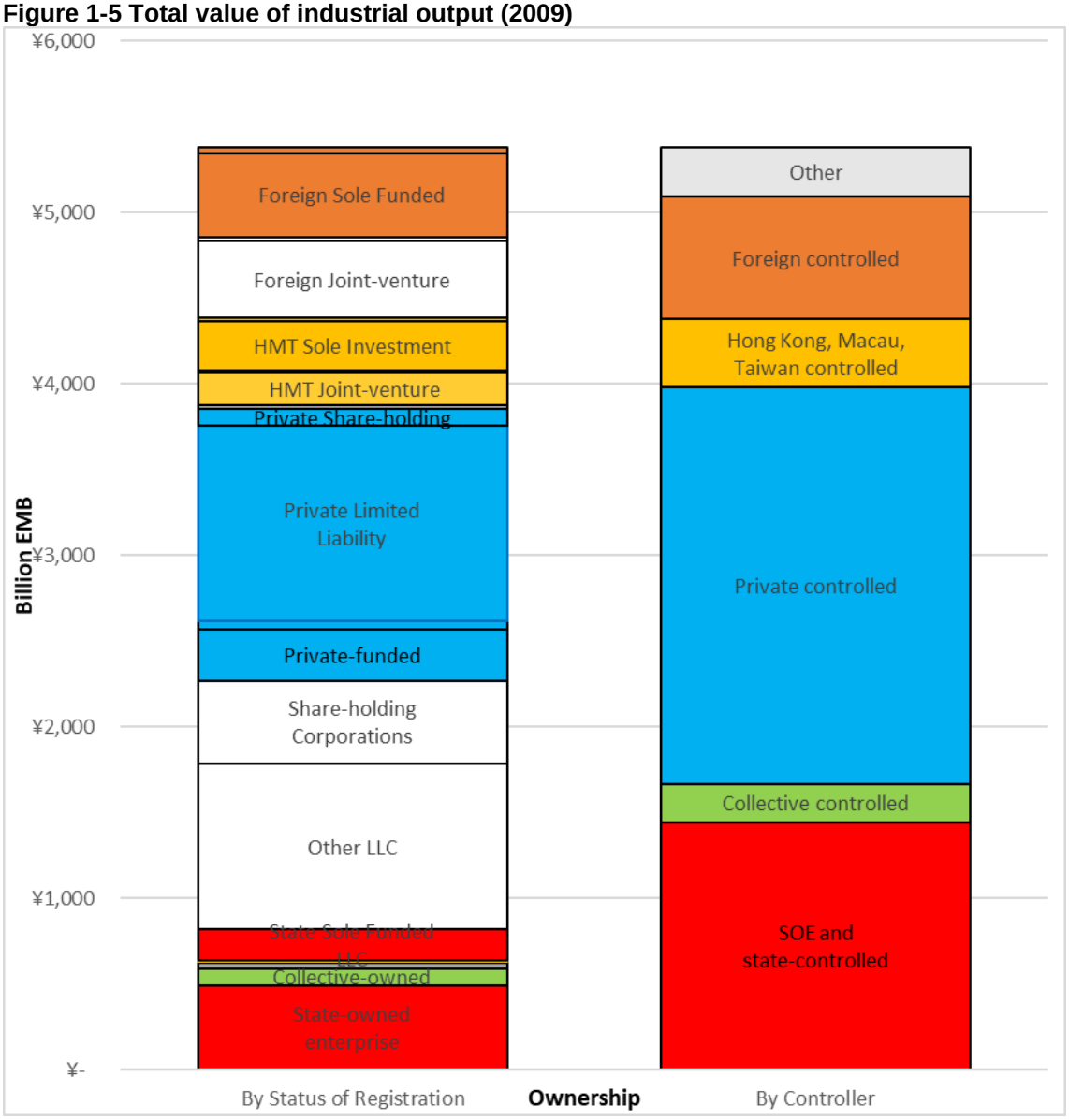
A broader NBS definition of 'state-owned and state-holding company' employs a more useful concept of control that goes beyond formal registration. According to explanatory notes provided in the China Statistical Yearbook, this category (more accurately translated as state-owned and state-controlled enterprises) includes not only SOEs (as strictly defined) but also 'enterprises with mixed ownership, … where the percentage of State assets (or shares by the State) is larger than any other single shareholder of the same enterprise' (National Bureau of Statistics of China, 2013).

This is broader than the registration measures since it includes the subsidiaries of (formally registered) SOEs in which the state, an SOE or an SOE subsidiary (and so on, recursively), is the largest single capital provider. This concept therefore not only includes SOEs that are directly administered by SASAC or another state organ, but also their partly-owned subsidiaries, joint ventures and listed companies in which they are controlling shareholders. Unlike the narrow definition, it captures the sometimes elaborate holding structures of SOEs (National Bureau of Statistics of China, 2013) which will be considered in Chapter 3.

Figure 1-5 shows the total value of industrial output for 2009 according to both definitions. It shows that reliance on the (narrow) registration fails to observe half the industrial output of enterprises that are ultimately controlled by the state (including through other SOEs). Unless otherwise stated, the control concept is followed for the remainder of this thesis.[13]

[13] See Lardy (2014, pp. 62–68) for comprehensive discussion of the biases introduced by reliance on the narrower official registration statistics.

Figure 1-5 Total value of industrial output (2009)



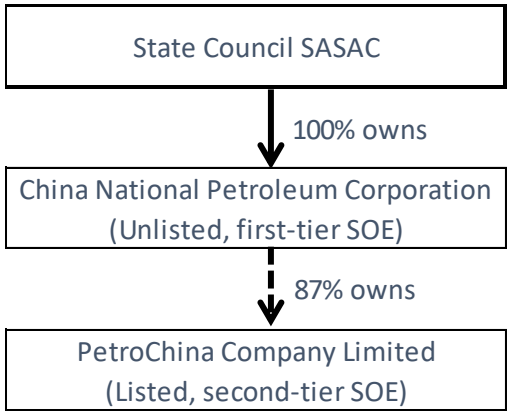
Source NBS Survey of above-scale industrial enterprises (described in section 4.1.1)

1.3.3 Mixed capital – State-controlled

A common mode of mixed ownership is to list SOE subsidiaries on stock exchanges. Provided that the state owner (or another SOE) remains the largest shareholder, such listed SOE subsidiaries remain SOEs under the broader definition of control (Lardy, 2014, p. 46).

Figure 1-6 illustrates that China's largest company by assets, the China National Petroleum Corporation (CNPC), is directly administered by central SASAC. CNPC was formed from a state oil ministry in 1988. A decade later, CNPC's core assets in extraction, refining, chemical and retailing were restructured into a subsidiary called 'PetroChina'. This subsidiary was listed on the Hong Kong and New York Stock Exchanges in March 2000 (Wu, 2005, p. 157). PetroChina is an example of an indirectly controlled, mixed ownership SOE. The parent's direct share is 87 per cent.

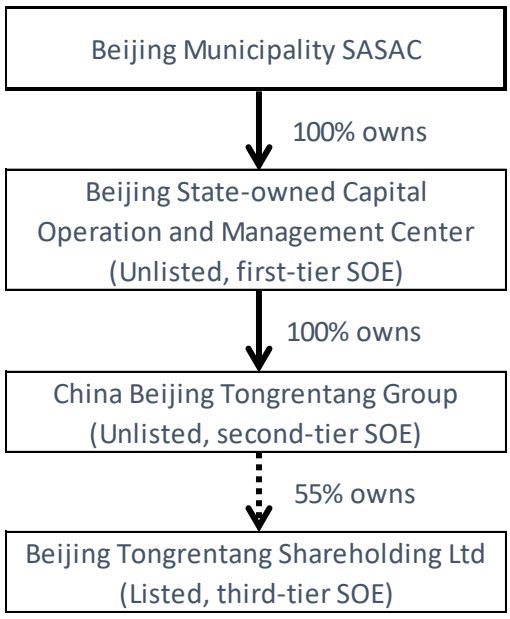
Figure 1-6 PetroChina, an indirectly-controlled, central SOE subsidiary



Source Author's diagram (Brødsgaard *et al.*, 2017, fig. 3)

Subsidiaries of directly state-owned companies can also have their own listed or unlisted entities. In principle, there is no limit to the number of corporate entities that can be interspersed between the directly administered SOE and companies that are under its ultimate control. For example, Tongrentang is a traditional Chinese medicine company founded in 1669 during the Qing dynasty. Figure 1-7 shows that the China Beijing Tongrentang Group is a wholly-owned subsidiary of a capital management company that sits directly under Beijing municipality SASAC. The Tongrentang Group owns a majority stake in Beijing Tongrentang Shareholding Ltd, which is listed on the Shanghai Stock Exchange.

Figure 1-7 Beijing Tongrentang Shareholding, Ltd an indirectly-controlled, local SOE subsidiary.



Source Author's diagram (Brødsgaard *et al.*, 2017, fig. 4)

Tracing ownership of listed Chinese companies takes hours of work for each company. Central SOE China National Chemical Corporation (ChinaChem) has at least nine listed subsidiaries (including 17 interspersed companies and a joint venture with Guangzhou City SASAC) (Rooker, 2016b). Bright Foods, which is ultimately owned by Shanghai SASAC, has direct and indirect interests in five listed subsidiaries (Rooker, 2016a).

Only the parent SOE comes under the direct administration of a state agency (usually SASAC). The state owner controls these indirectly through vertically overlapping executive appointments that create a career path from subsidiary companies up to the parent (Fu, 2013). The SOE and its subsidiaries, including listed subsidiaries (Zhang, 2012), each have a Party organisation that guides both key personnel appointments and key business decisions. According to the Party Constitution, the Party organisation within the SOE 'guarantees and oversees the implementation of the principles and policies of the Party and the state in (the) … enterprise and backs the meeting of shareholders, board of directors, board of supervisors and manager (factory director) in the exercise of their functions and powers according to law' (Xinhua, 2013).

The result of these arrangements is that even if a single state owner can be identified as the 'ultimate controlling owner', the actual degree of control or even interest that the state owner plays in the firm can be attenuated by the holding structures employed. Joint venture structures have also been used to allow corporate engagement between the state sector and foreign investors, in order to attract foreign technology to China, most notably in the automotive sector (see discussion in Section 4.2.2.1). More generally, the use of complex corporate structures might increase market responsiveness and efficiency by attenuating opportunities for political interference in enterprise affairs (Fan, Wong and Zhang, 2013).

For example, Meyer and Lu (2004) provide a case study of the China International Marine Container (Group) Company, Ltd. (CIMC), a manufacturer of shipping containers. CIMC had been listed on the Shenzhen stock exchange, with the two equal-largest shareholdings held by a central SOE, the 'China Ocean Shipping (Group) Company' (COSCO) and the China Merchants Container Industry Co. Ltd (CMCI), which was a wholly-owned subsidiary of a holding company listed in Hong Kong that itself was controlled by the Chinese Ministry of Transportation. Although the resulting company was a 'state-owned or state holding company' since the largest shareholder was itself an SOE, Meyer and Lu describe both how the listed structure insulated the company from direct interference from government ministries, and how the joint venture arrangement between COSCO and CMCI prevented dominance by either company. For example, while the COSCO Party Committee appointed the Chairman of the CIMC board of directors, the longstanding general manager (and chairman of the CIMC Party Committee) reported directly to the Organization Department of the Shenzhen Party Committee and operated with considerable autonomy.

1.3.4 Mixed capital – Non-state controlled

Classification as a non-state-controlled enterprise does not preclude state or Party participation. Enterprises may have a controlling private shareholder, with minority SOE shareholdings, in which case it might be better thought of as a mixed ownership enterprise (Scissors, 2016). The starkest example of mixed ownership would be a privately-controlled enterprise in which the state has a 49 per cent share, but could include much more subtle configurations. An SOE (or its subsidiary) might have taken a non-controlling equity stake in a publicly-listed non-state company. It could also include the case where a formerly state-owned enterprise has been partially privatised, but in which the state retains some small shareholding.

The definition of 'state-owned and state controlled' is also non-cumulative – for example, company A might be 49 per cent state-owned and 51 per cent owned by a private shareholder, in which case it is classified as privately controlled. Suppose they create a new company, company B, in which company A holds a 51 per cent stake, with the remaining 49 per cent owned by wholly state-owned enterprise B. In this case, company C is not 'state controlled' because its controlling parent is not state-controlled. Nevertheless, the state would remain the ultimate beneficial owner of almost three quarters of company C.[14]

It is not possible to tell from the NBS statistics the extent of this mixed ownership. NBS does report annual series on owners' equity for industrial firms, including a series for the 'state capital' component. This is also broken down for 'state-owned and state holding' enterprises, HMT enterprises and 'private enterprises'.

Table 1-2, based on the 2007 NBS survey shows 7,857 enterprises that were 'state controlled' but have no recorded state capital. These are likely to be indirect subsidiaries of SOEs. It also shows 1,229 privately controlled entities with some state capital. There are also 279 'private' entities that are majority or wholly state-owned based on capital shares. These are likely to be enterprises that were previously state owned but have since entered mixed ownership with a majority private shareholder, without updating registered capital.

Table 1-2 Number of industrial enterprises according to state capital share (2007)

	State capital share of total capital				
	None	Minority	Majority	Wholly	All
SOE and state-controlled	7,857	842	2,249	9,298	20,246
Collective	22,945	446	76	105	23,572
Private	232,929	1,229	159	120	234,437
Hong Kong, Macau, Taiwan	27,476	342	24	8	27,850
Foreign	28,532	579	47	5	29,163
Total	319,739	3,438	2,555	9,536	335,268

Source 2007 Survey of above-scale industrial enterprises (described in section 4.1.1)

[14] Thanks to Derek Scissors for this example.

The Party has channels for engagement even within companies that have no formal state ownership share. Article 17 of China's 2004 Company Law made explicit that 'grass roots organizations of the Communist Party' are allowed to carry out their activities in companies (even foreign companies) in accordance with the Party Constitution. Article 19 of the 2013 revision of the Company Law strengthened this provision by adding the further provision that a 'company shall provide the necessary conditions for the activities of the party organization'.

Reportedly 'all 210,000 large private companies' now have Party committees and have recruited more than 3.5 million workers (Xinhua, 2012). Nevertheless, the Party's mandate is weaker than in SOEs (Lardy, 2014, p. 121). In a private enterprise, the Party committee is meant to 'guide and oversee the enterprise in observing (state) laws and regulations.' It comes with a pro-business rider that the Committee 'stimulates the healthy development of the enterprise' (Hawes, 2007, p. 818). Such businesses might be able to exploit political links, for example through government or military experience of top leaders (Wu, Wu and Rui, 2012), but unlike in the SOE, neither the State nor the Party control personnel movements.

1.4 Conclusion

The modern conception of SOEs as independent legal entities, existing in a property relationship with parts of the Chinese state system, and operating in a market economy, is a fundamental departure from their origins as part of the state apparatus in a centrally-planned economy. While work units were an integral part of the state planning apparatus, modern SOEs have become now standalone legal entities that exist in a property relationship to the state. In some cases there is a direct ownership relation, in which control is maintained by direct appointment of management through State or Party personnel systems. But in many enterprises are only indirectly state-controlled through other SOEs. The boundary between state and private enterprise is further blurred when the state – or an SOE – becomes a non-controlling equity owner in an otherwise private firm.

Despite the evidence of historically poor SOE performance and a commitment to market efficiency, the Chinese government remains committed to a 'socialist' market economy, that emphasises public ownership in some form. The next chapter provides a framework to consider the potential role for SOEs in different sectors from the perspective of the state owner. Subsequent chapters respond in order to the key questions set out in Section 1.1.

Chapter 2: Profit and policy objectives of state-owned enterprises

External criticism of China's SOEs focuses on their low profitability relative to private firms. When is profit the most appropriate performance measure, and what is the appropriate profit benchmark for comparison? This depends on the underlying assumptions about market structures and information. Section 2.1 sets out the case for profit maximisation given neoclassical assumptions of perfect competition. Section 2.2 then extends the analysis to consider the broader range of objectives available in markets with imperfect competition and incomplete information. Under such circumstances, financial profit may cease to be a good measure of efficiency.

Even where profit is the most appropriate benchmark, how should an absence of profit be interpreted? Is this evidence of shirking, inefficiency and waste? Or could potential profits be captured by insiders – through on the job consumption or above-market compensation? These questions are considered in section 2.3.

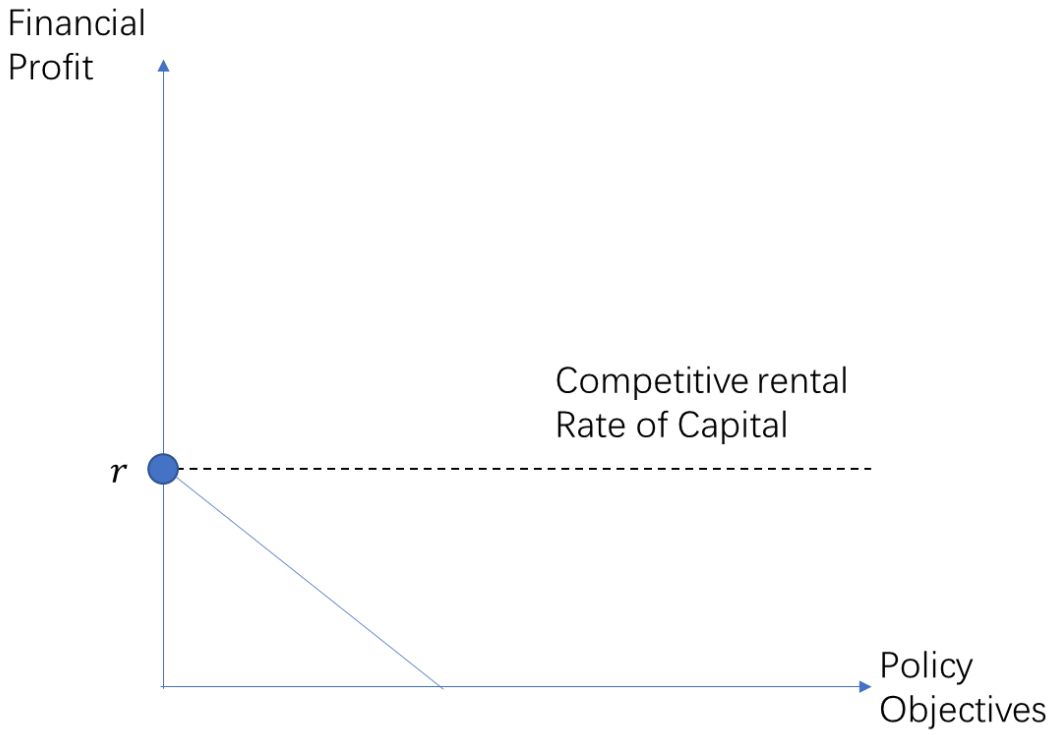
2.1 Profit maximisation and perfect competition

The notion that firms *do* maximise profits (that is, that profit maximisiation is an objective and accurate description of firm behaviour) and that firms *should* maximise profits (that is, profit maximisation by firms is normatively desirable), derives from neoclassical assumptions of perfect market competition. Profits here are the residual claim on firm revenue after compensation is paid to labour at the prevailing market wage, and rental payments have been made to owners of capital at the market rate of interest. Since all productive factors of production have been compensated, profits in this model are a form of rent.

Alchian (1950) established an objective theoretical basis for profit maximisation of the representative firm, even if no specific firm can be found that behaves in this way. In a competitive market, with no barriers to entry, the existence of average firm profits that are over and above the competitive rental cost of capital will induce profit-seeking entrepreneurs to enter the market. This new competition expands supply and therefore lowers prices, until the expected rate of profit for a new entrepreneur is no higher than is available in other markets. In a world of perfect competition and knowledge, the maximum economic profit is zero. So the marginal firm earning zero profits is, trivially, profit maximising. A firm that fails to maximise profits is therefore making a loss, and without an ongoing subsidy cannot remain viable. It is then forced to exit the market, freeing up capital for more productive uses elsewhere.

This profit-maximising point can be illustrated as a single point on the production possibility frontier in Figure 2-1.[15] Facing a perfectly competitive market, the firm's financial profits are sufficient to cover the competitive rental rate of capital (r) and no more. Without subsidy, it has no scope to pursue costly policy objectives that deviate from profit maximisation. In this special case, the "primacy of competition versus ownership" (Vining and Boardman, 1992) can be established – the subjective character of the owner becomes irrelevant in the long run (Wu, 2005, p. 12). To the extent that a state-owned firm could exist without subsidy in a perfectly competitive market, it would behave identically to a private profit-maximising firm. Firms that pursue costly policy objectives would become unviable and leave the market.

Figure 2-1 Profit-maximising point in perfectly competitive market



The first fundamental theorem of welfare economics provides that perfect competition maximises social welfare in a world without externalities, public goods or imperfect information (Blaug, 2007, p. 185). Given that profit-maximising behaviour maximises social welfare, there is no need (under these strict assumptions) for state-owned firms to pursue any other policy objectives. An omniscient and benevolent social planner might seek to redistribute income in accordance with the planner's own distributional preferences (Barone, 1908), but could not intervene to increase output any further (Lange, 1936; Wu, 2005, p. 13).

If profit-maximisation provides for an efficient outcome, then evidence of persistent deviation from profit maximisation is evidence of departure from the competitive equilibrium. It is inefficient. Differential financial returns between SOEs and non-SOEs would indeed be a

[15] Introduced in the previous chapter (Figure 1-3)

measure of SOE inefficiency under these strict assumptions. While there is no general efficiency argument for having the state as an owner of capital, the persistence of state ownership while maintaining competitive efficiency requires the state to act identically to a profit-seeking private owner. A state sovereign wealth fund with a mandate to behave as an entirely passive investor might provide the closest example.

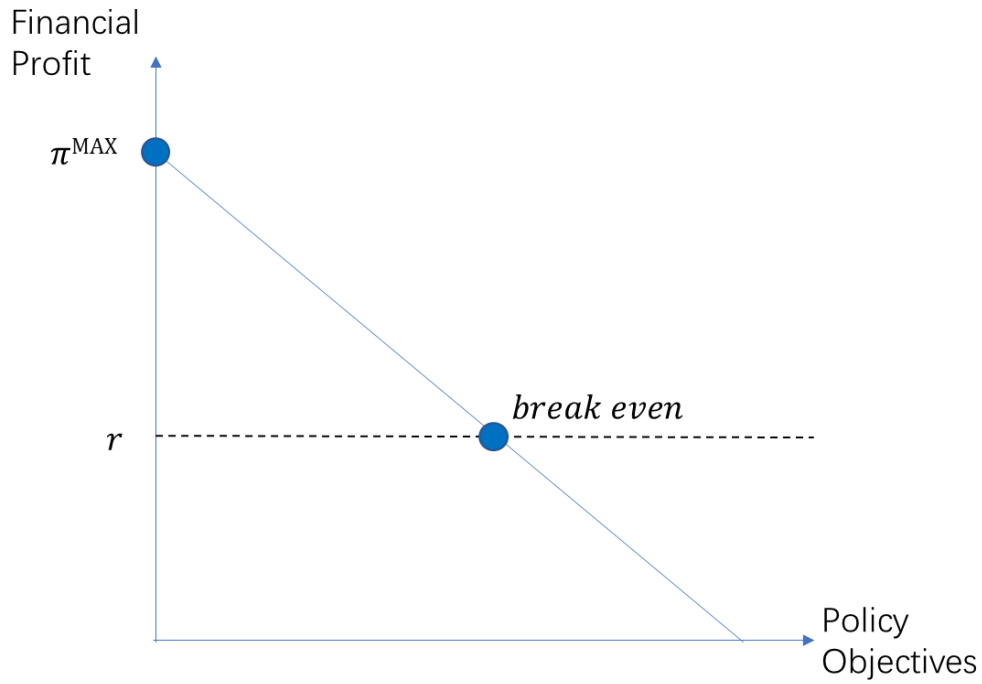
Provided there are no market failures that might otherwise justify state intervention, profit is therefore an appropriate measure for SOE performance. Whether a firm is private or state owned, provided it maximises profits it would be an efficient firm. The relative performance of the small number of Chinese SOEs that exist in conditions close to this will be explored later (Chapter 5.3).

2.2 Policy objectives given imperfect markets and uncertainty

While the neoclassical model provides a powerful analytical framework, it is an incomplete guide for policy in real economies. Governments do intervene in markets, and SOEs are one of many available policy instruments. The welfare case for SOEs depends on identifying those markets where real world conditions depart from competitive market assumptions. This departure can occur because of institutional factors (for example, the monopolisation of industry as observed in the previous chapter), or due to the nature of the underlying production technology (for example, the natural monopoly features of network utilities).

The representative firm in the perfectly competitive model above was a profit maximiser, since that was the objective consistent with continued viability. There was no need to inquire as to the firm's subjective intentions or its internal governance. However, as Figure 2-2 shows, when financial profits are possible above the competitive (risk-free) rate of return (r), a range of viable firm objectives become available once more. The subjective intent of the firm's controller becomes relevant again – choosing between the maximisation of financial returns, the maximisation of policy objectives, or some combination that constitutes a trade-off between them – subject to the constraint that financial returns are sufficient for the firm to meet the minimum demands of the firm's creditors (that is, to break even).

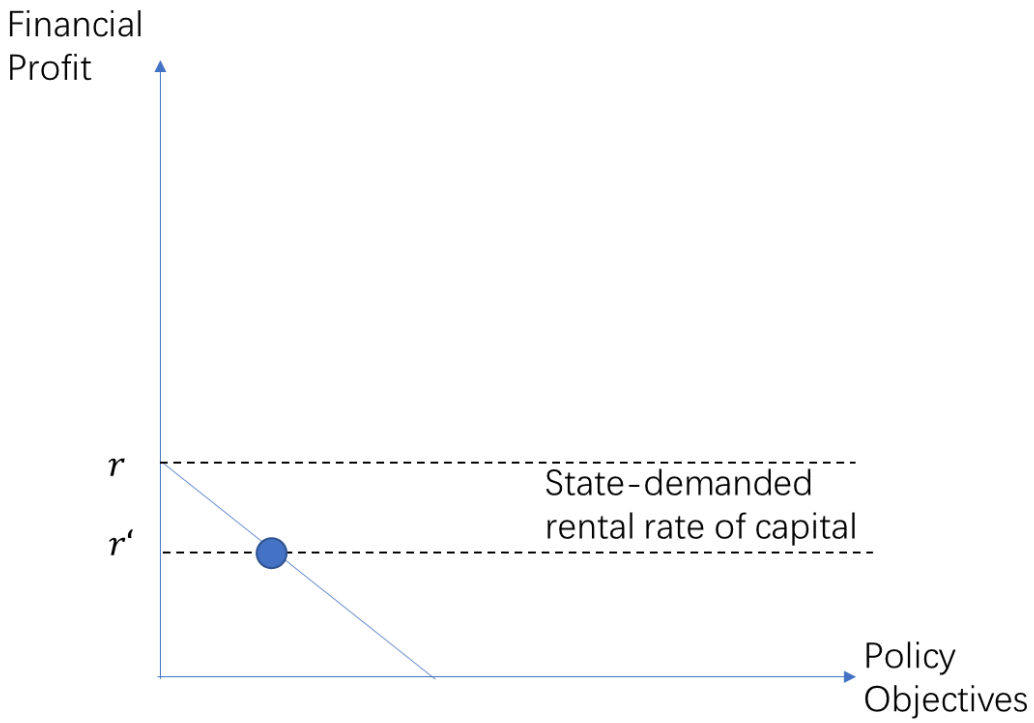
Figure 2-2 Choice of objectives given positive economic profits.



Uncertainty about the future is a source of persistent positive profits in the real world (Knight, 1921). This is compounded in transition economies like China, where reforms to the political and economic institutions generates additional uncertainty about the sustainability of certain policies. The private, profit-seeking investor facing uncertain policies demands a higher rate of return to compensate for the risk of policy change (Rodrik, 1991). China's gradual and sometimes piecemeal reform perhaps contributes to policy uncertainty. But the failure of rapid privatisation ('shock therapy') to deliver prosperity in the post-Communist transition economies of the former Soviet bloc suggests that there is no short-cut alternative to the slow process of institution building, such as the rule of law, as a precondition before mass ownership reform (Hamm, King and Stuckler, 2012, pp. 7–8). If state actors have better knowledge of the future path of policy reform (or can protect the value of their investment through other means), then the state owner may accept a lower rate of return than the private owner who required additional compensation for this policy uncertainty.

Even where there is competitive market pressure, the state can expand the range of potential policy objectives through subsidies. The previous chapter showed that, as a condition of WTO entry, China agreed to remove its direct fiscal subsidies to its loss-making SOEs. However, it is still open to making otherwise non-viable SOEs profitable by tolerating a rate of return below the competitive rental rate of capital (Huang, 2010; Lardy, 2014, pp. 22–23). The state can provide this either directly as an owner (i.e, equity holder) by not demanding a competitive return on its equity, or as a creditor, by acting through the state-owned banking system. This is represented in Figure 2-3 by providing a lower rate of return (r') for some SOEs, which recovers the possibility of departing from non-profit objectives.

Figure 2-3 Subsidy to capital allows the pursuit of policy objectives despite competition



Whether the viability of non-profit maximising firms arises from the imperfect nature of market competition or from an indirect subsidy on the part of the capital owner, potential SOE profits can be exchanged for policy objectives, along the production possibility frontier. In this case, the value of the policy objective needs to be compared to the cost of the foregone profit. A complete assessment of the costs and benefits of using an SOE to achieve any given policy objective should also compare this with alternative, available policy instruments available to achieve the same objective, rather than with some theoretically perfect, but unattainable benchmark (Demsetz, 1969).

The policy tools available at any given time will be contingent on the administrative capacity of the state. In the early stages of reform, and in the absence of a general social safety net, poor profitability of SOEs may have been tolerated as a second-best mechanism to provide social services to state workers (Putterman, 1995, p. 1061). For example, in the historical case where SOEs were required to provide health services to their employees, it may be the case that direct state provision of health services can be done at lower cost per worker (perhaps, because of economies of scale from larger hospitals rather than smaller clinics). This is an empirical question that would need to be decided through a careful analysis of policy objectives.

The perceived value of using SOEs for political purposes is likely to vary between observers. The Party may be willing to trade off profit to pay off potential ‘losers’ from economic reform (Lau, Qian and Roland, 2000), or even to ensure political loyalty of firm

managers (Zakharov, 2014). Those who have a political objection to the Party may object to a departure from profit maximisation by SOEs precisely because they disagree with the policy objectives of the Party.

Even if a conventional economic approach is adopted (that is, setting aside political valuations), the departure from a model of perfect competition means that there are cases – most notably natural monopolies – in which profit-maximisation does not maximise social welfare. State ownership with non-profit objectives may be a viable alternative to attempted regulation of private monopolies. This is considered in the next section.

The potential for rents (whether deriving from imperfect market structures, uncertainty or natural resource rents) also means that the financial profits of firms may no longer be an accurate measure of capital returns. Allocative efficiency still requires equalisation of the marginal rate of return on capital between firms and between industries. But the marginal return on capital is not directly observable from financial profits. Nevertheless, profit maximisation may be an efficient goal – with profit-maximising SOEs a potential alternative to taxing rents from private enterprises. This considered in section 2.2.2.

2.2.1 When profit maximisation is not socially efficient

The efficiency case for profit maximisation in the perfectly competitive case rests on the assumption that, in the long run, there are no excess profits in the industry. The free market is free of rents. The introduction of potential rents into the model quickly shows that profit maximisation no longer maximises social welfare: a textbook profit-maximising monopolist restricts supply to drive price above the marginal cost of production. In this case, the quantity demanded may be significantly reduced at the higher price, the producer gains additional profit based on the difference at the expense of the consumer. There is an additional (static) welfare loss from consumer surplus that is no longer gained from those units that are not produced. The extent to which output is reduced depends on the elasticity of demand for the good.

Sometimes new entrants are inhibited by the existence of regulations or laws that prohibit competition. This was the case for Chinese industry from the nationalisation of industry until the advent of non-state competition in the reform and opening up period, as described in Chapter 1. Yet even in the absence of formal barriers to entry, some industries are naturally monopolistic because of the underlying production technology. Naturally monopolistic industries typically carry high fixed costs but low and often declining marginal production costs (for example, an electricity network, transportation network, or telecommunications network). In such an industry, a new entrant cannot expect to recover the (high) fixed cost of its initial investment at the (low) competitive price.

In an industry that is not readily open to competition by new profit-seeking entrants, above-normal industry profits may persist. However, these additional profits are a symptom of

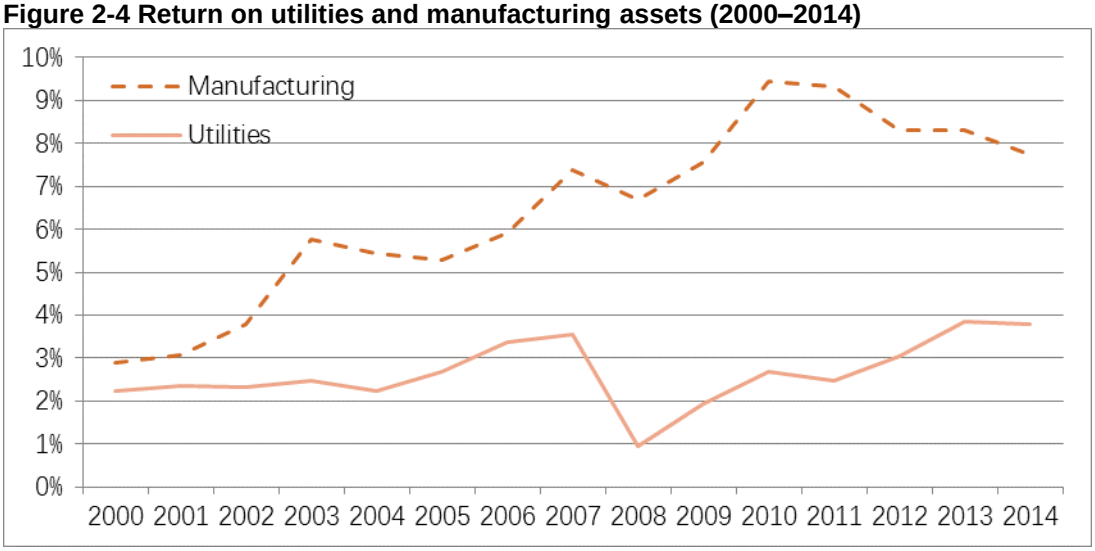
monopoly inefficiency, rather than efficient use of capital. While the owner of the monopoly may gain, the overall economy is smaller. The efficient equilibrium, at which the marginal product of capital is equal across all uses, requires the monopolist to expand output again, lowering price – and their profit – back to the competitive level.

The welfare loss of a profit-maximising monopoly is greater when it is in an upstream industry (such as electricity distribution) that provides inputs into the rest of the economy. Price distortions in these markets compound through the industrial structure – high profits from SOEs in such sectors effectively act as a tax on downstream producers and consumers (Schmitz, 2001).

In the absence of an efficient free market solution, avoiding the welfare costs of a private profit-seeking monopoly tends to rely on the state either regulating the monopolist in order to constrain its behaviour to act more consistently with social welfare objectives, or adopting a policy of outright ownership in which the state operates the monopoly itself according to non-profit objectives (Demsetz, 1968; Posner, 1969; Foster, 1993). A carefully selected non-profit objective under these conditions can lead to better welfare outcomes than profit maximisation.

The profitability of manufacturing firms producing private goods under competitive conditions (considered in Chapter 4) will not be a reliable benchmark for the efficiency of utilities with non-profit objectives. That is why Figure 2-4, which shows that the aggregate profitability of utilities in China (distribution of electricity, water and gas) is much lower than that of Chinese manufacturing says little about the relative efficiency of each sector, given their likely different objectives.

Figure 2-4 Return on utilities and manufacturing assets (2000–2014)



Source Author's calculations based on NBS China Statistical Yearbook (various years)

Lardy (2014, p. 13) suggests that the behaviour of Chinese SOEs in these sectors might be explained as simply the reinvestment of retained (monopoly) earnings. This behaviour is not

necessarily efficient and may effectively subsidise downstream industries, but it is not unequivocally less efficient than the profit-maximising monopolist's choice to restrict investment and drive up prices – which would reduce production in downstream industries.

The key point is that the efficiency of network utilities should be judged based on economy-wide (social) costs and benefits, rather than a straight observation of financial returns to the firm, as if its production were in a competitive private market with no externalities. This separation of competitive and non-competitive components of industry, and further reforms in non-competitive sectors, were also part of the Third Plenum Decision (noted at the beginning of this thesis):

> In natural monopoly industries in which state-owned capital continues to be the control (sic) shareholder, we will carry out reform focusing on separation of government administration from enterprise management, separation of government administration from state assets management, franchise operation, and government oversight, separate networks from operations and decontrol competitive businesses based on the characteristics of different industries, and make public resource allocation more market-oriented. (Communist Party of China, 2014)

This approach is not unique to China and does not provide evidence of a uniquely Chinese state capitalism. China's State Grid stands out internationally because of its size; but this is potentially derived from China's own status as the largest economy in the world (in PPP terms). Norway, Korea, Italy and France are OECD economies that still have major electricity or gas SOEs (OECD, 2014, p. 11). Even the United States' federal government is involved in various regional 'power administrations', the largest of which is the Tennessee Valley Authority. The Authority was created in 1933 and 70 years later controlled over one hundred hydroelectric, coal and nuclear power plants (Geddes, 2004, p. 45).

In such markets, performance needs to be assessed based on sector-specific regulatory arrangements and policy objectives, rather than raw profitability.[16] Where benchmarking against private profit-seeking competitors is not feasible, alternative performance benchmarks across time or internationally may be required. For example, the 2013 reorganisation of the Ministry of Railways (an organ of the state) into the China Railway Corporation (an SOE) provides an opportunity to benchmark the performance of the new Corporation against that of the previous Ministry. The performance comparison is unlikely to be financial profits.

2.2.2 When financial profits include other rents

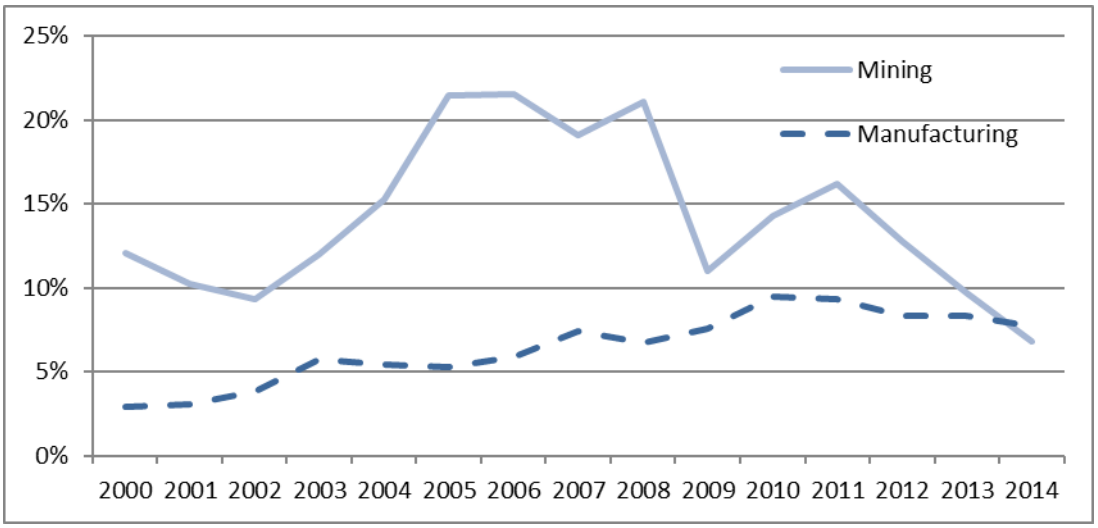
Where there are rents are not dissipated through competition, the use of SOEs may provide a mechanism for the state to appropriate them. This allows the state to reduce (or avoid

[16] Relevant studies relating to electricity in China include Yeh and Lewis (2004), Xuegong et al (2013).

imposing) otherwise distorting taxes on other factors of production, or direct taxes on private resource companies that may not be fully cooperative with the tax authorities (Garnaut and Clunies Ross, 1975)

Figure 2-5 shows the relatively high return on assets for mining companies in China prior to 2009. The Unirule Institute for Economics (2011, p. 61) argues that the low cost of natural resources is a major factor explaining the (previously) high profits for mining SOEs – calculating that the low rate of royalties payable by SOEs for their access to coal, oil and natural gas amounted to 497.7 billion RMB from 2001 to 2009. Anderson (cited in Lardy, 2014, p. 125) suggests that their declining profitability from 2009 is most likely explained by declining commodity prices after the Global Financial Crisis.

Figure 2-5 Return on mining and manufacturing assets (2000–2014)



Source Author's calculations based on NBS Statistical Yearbook (various years)

This tendency of resource company profits to include large natural resource rents confounds a direct comparison with the profitability of fully competitive industries. The divergence in profitability between resource firms and non-resource firms is not by itself evidence of inefficiency in the allocation of capital. Diagnosing capital misallocation requires an observation of returns excluding rents.

As with electricity, the existence of large state-owned resource companies is not unique to China. State ownership or control of oil companies is common across the Middle Eastern countries, Libya, Nigeria, India, Venezuela, Mexico, Indonesia, Malaysia, Russia, Algeria and Norway (Pirog, 2007, p. 20). For many former colonies, the creation and control of a national oil company became an important symbol of political independence (Stevens, 2008, p. 13). The alternative to state ownership is not always robust competition. Robinson (1941, pp. 197–205) provides an account of how John D. Rockefeller's private oil company, Standard Oil, came to refine 95 per cent of US output by 1879. The eventual American response was to adopt

anti-trust policies that today are administered by the United States' Federal Trade Commission. The performance of national oil companies should best be judged against private oil companies. When it is, evidence regarding relative efficiency is mixed (Al-Obaidan and Scully, 1992; Wolf, 2009).

The appropriation of rents through state ownership also needs to be compared against the costs of collecting revenue in other ways. States can monopolise the use of force[17] to control markets for inelastically-demanded consumer commodities (for example tobacco, alcohol, and salt) for revenue purposes. This is equivalent to imposing a narrow-based excise tax, and has been a common feature of taxation systems since classical times (Rich and Wilson, 1967, p. 289).

China's salt monopoly dated from the Han dynasty (Fairbank and Goldman, 2006) through to the establishment in 1950 of what is now the China National Salt Industry Corporation. Although salt is no longer a major revenue source, the state monopoly was defended on multiple non-profit justifications of stewarding mineral resources, ensuring public health (by requiring iodine fortification), contributing to taxation revenues, and protecting consumers (especially the poor) from price fluctuations of an essential commodity (Gu, 2002). The state monopoly was only relaxed in 2017 when producers were finally allowed to sell directly to market (Hancock, 2017).

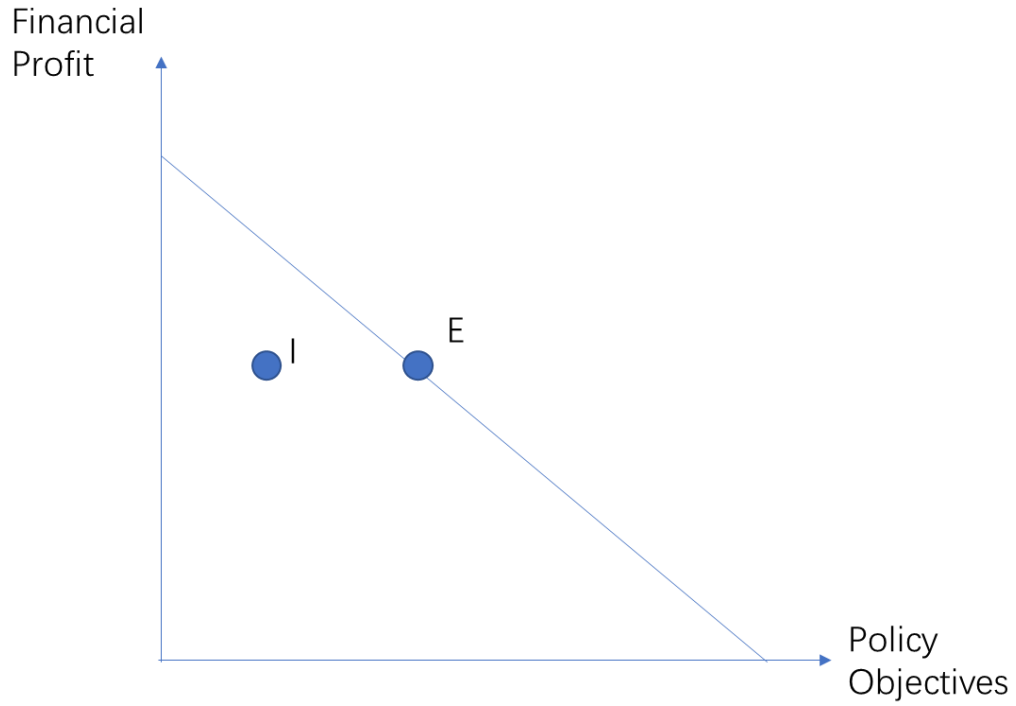
Tobacco monopolies are also common. Since the establishment of the Spanish tobacco monopoly in 1636, tobacco monopolies were imposed largely as revenue source revenue. They were imposed in Europe, Japan and the Soviet Union, although they were phased out of the European Union under the 1970 Common Agricultural Policy (Comin, 2005). Tobacco remains heavily taxed, though no longer state owned, in all OECD economies (OECD, 2016a, p. 145). Chinese tobacco has remained centrally owned and centrally planned even during the reform and opening-up period (Wang, 2013).

2.3 Inefficiency and corporate governance

Even if a state owner makes a rational choice between profit and a particular policy objective, the SOE may still fail to deliver. This is illustrated in Figure 2-6, which shows the owner's policy objectives at an efficient point E on the frontier. The SOE will report a lower rate of profitability than if it were maximising financial profits, but this is offset by the creation of value elsewhere. However, the SOE may fail to deliver the expect policy objectives. In this case, the value of output falls to an inefficient point I inside the frontier.

[17] In 2000, enforcers of China's salt monopoly in Hunan province confiscated 7,277 tons of contraband salt and detained 88 people, of whom 11 were arrested, four were re-educated through labour, and four were sentenced (Gu, 2002, p. 5).

Figure 2-6 Inefficient output despite efficient choice of objectives



Such a failure of an enterprise to achieve the objectives of its owners is not unique to SOEs. Since Berle and Means (1948) identified the separation of corporate ownership and control as a departure from the classical notion of the owner-manager, a broad discipline of corporate governance has been developed to align the interests of owners and managers. Where there is a separation between (public or private) firm owners and day-to-day management, the task of corporate governance is to align incentives of owners and managers. This is necessary even for a profit maximisation goal.

The convention that enterprise profits be assigned to passive shareholders of the firm arose from Anglo-American legal precedent (Berle and Means, 1948, pp. 333–339). Yet there is a persuasive efficiency argument to assign at least some of the residual claim to firm insiders who are better informed to increase profits (Berle and Means, 1948, pp. 349–350). The construction of performance-linked management bonuses, stock options, and employee share schemes are examples of attempts to induce firm management to improve firm efficiency. The early SOE reforms that allowed work units to share in the fruits of above-plan production are another example.

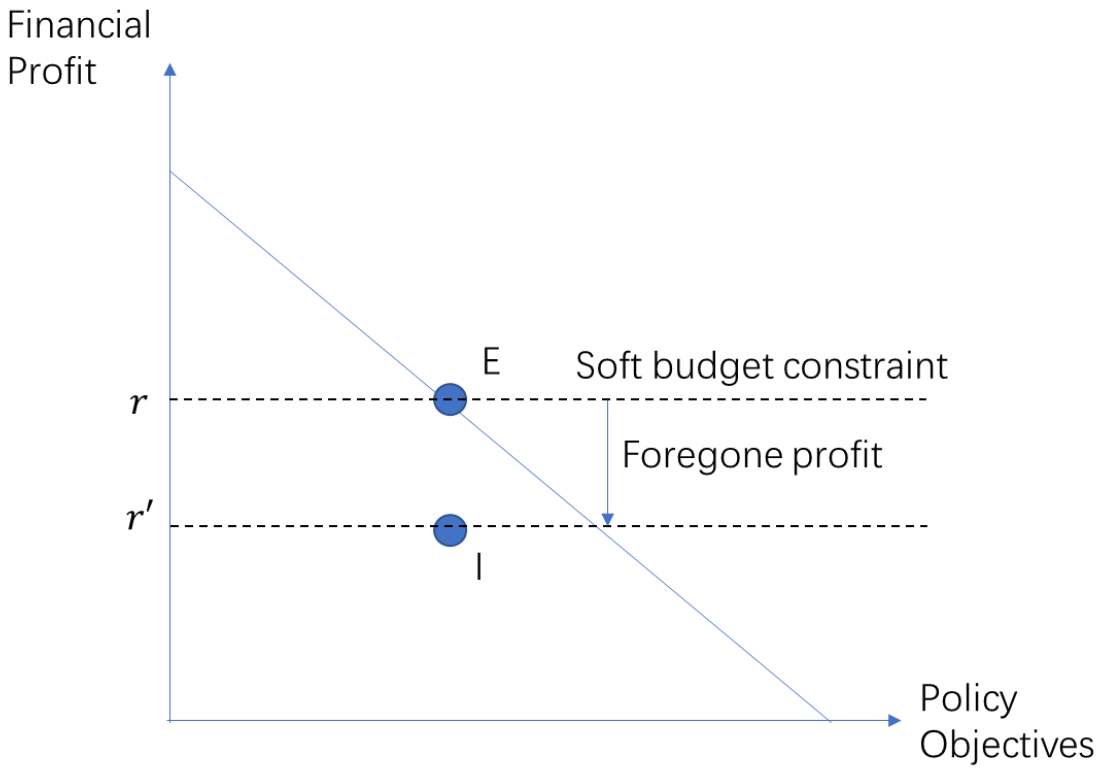
Where there is a single, transparent objective the use of high-powered incentives such as profit sharing may be an effective means of aligning the interests of owners and managers (Naughton, 2018, p. 374,378). But these can fail or be ‘gamed’ by managers faced with multiple – often ambiguous or competing – policy objectives (Levy, 1987; Wu, 2005, p. 140). Particularly in cases where the value placed on policy objectives depends on a political value judgment, or the priority between different policy objectives changes according to political

factors, political loyalty of the manager becomes more important than technical competence (Zakharov, 2014).

The lack of a clear and binding financial performance indicator creates conditions for the so-called 'soft-budget constraint syndrome'. This has been used to describe the chronic inefficiency of SOEs across all socialist economies, including China (Kornai, 1992, p. 13; Bai and Wang, 1998; Dong and Putterman, 2003).

Figure 2-7 illustrates the financial rate of return expected of an SOE, as the broken horizontal line *r*. This rate of return may even be lower than the competitive rate of return if the state is expecting the firm to attain some set of policy objectives, at the efficient output combination E. But what happens if the cost of achieving the policy objectives was higher than expected, causing output to fall to I? The state owner would not have accepted this inefficient trade off in advance. But unless it is willing to sack the manager (or liquidate the firm) it must accept the lower rate of return at r'. The manager then learns that the original constraint was soft.

Figure 2-7 Inefficiency and soft budget constraint



This begs the question of why the state owner, once it discovers the soft budget constraint phenomenon, continues to tolerate it? The answer likely relates both to information and incentives on the state owner's part. The SOE manager may be informed from a technical perspective as to the real costs and benefits of different policy objectives. But he has no reason to reveal that information. The burden then falls on the state owner to expend effort to monitor the SOE output closely (Qi, Song and Liu, 2016). This is difficult because, unlike profit, policy objectives can be difficult to measure. Furthermore, while the state owner might always prefer

more profit to less (always to prefer point E to point I), it has its own internal principal-agent problems. The bureaucrat responsible for overseeing the SOE does not typically receive a share of the profits, and so lacks the private capitalist's incentive to expend any effort on monitoring (Zhang, 2006).

There are also political relationships between SOE managers and their supervisors, although they are not necessarily unique to state-owned firms (Lardy, 2014, pp. 119–120). Wang (2016) finds that publicly-listed non-SOEs are more likely to cultivate connections with members of People's Congresses or Consultative Committees, whereas SOEs are more likely to be connected to the bureaucracy and the People's Liberation Army. The problem is confounded when the political rank of the SOE manager may be higher than that of the agency tasked with regulating the SOE (Ahlers and Shen, 2017).

2.4 Value capture and waste

The previous subsection shows that the corporate governance problems inherent in the pursuit of multiple policy objectives results in the potential loss of value from the perspective of the state – this is simply the vertical distance from the output combination actually achieved back to the frontier (which represents a rational trade-off between profit and policy objectives). While this missing profit is evidence of inefficiency (by definition, because there is a departure from the frontier), to what extent does it reflect a loss to the economy overall? Is foregone profit wasted (through slack use of capital, shirking on behalf of labour, or some misallocation of the two), or is it – as in the case of theft (Tullock, 1967) – captured elsewhere?

The view that the foregone SOE profits are wasted is consistent with a view of SOEs as inherently inefficient and SOE managers and workers as inherently lazy. It accords with the plan-era incentives of the *work unit* and a management tradition of bureaucracy rather than business (Wu, 2005, p. 140). This view of ingrained SOE inefficiency is not just from China's historical experience but also that of other socialist countries (Kornai, 1992).

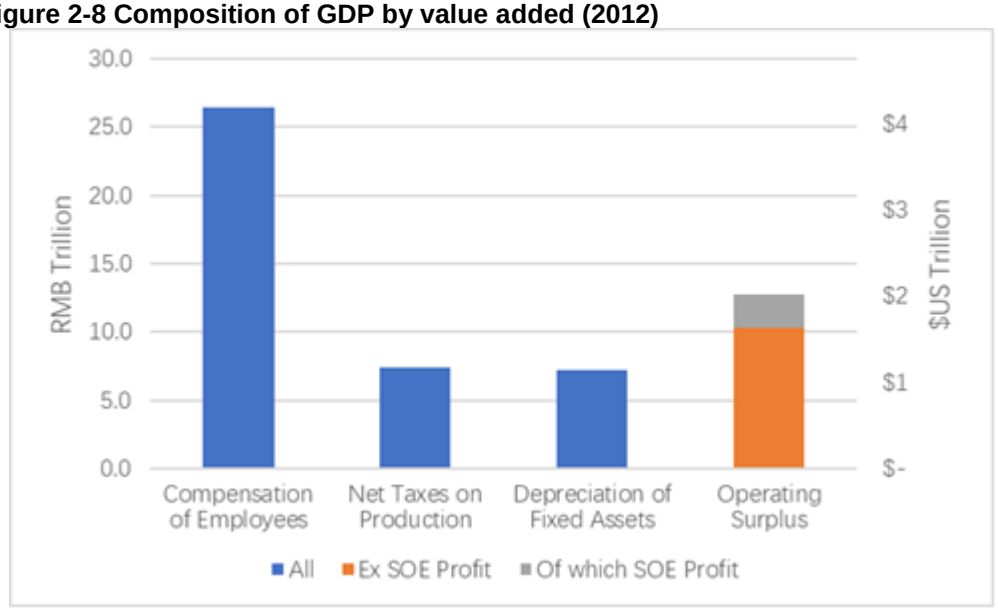
Yet the material incentives facing SOE management and workers vary. They can induce quite energetic behaviour when firm insiders are given the opportunity to capture resources for themselves. The theory of managerial capitalism suggests that professional managers run firms to pursue their own interests – whether they do this by paying themselves higher wages, giving themselves better working conditions, or acting scrupulously to increase profits for the shareholder-owner depends on the incentive structures they face (Marris 1964). This suggests that restricting channels by which management can capture a portion of firm surplus potentially encourages risk-aversion or shirking (reducing output) rather than increasing in profit for the state owner.

Wang's (2014) detailed case study of the Chinese tobacco industry through the 1980s and 1990s provides a compelling account of entrepreneurial management even in a sector that

remained monopolised by the state. Unlike other sectors undergoing reform, the tobacco industry and cigarette manufacturing remained subject to central administrative planning. Yet the manager of a provincial Yunnan cigarette factory, Chu Shijian, continually drove to modernise the factory and its production methods, convinced local peasants to change production plans to meet his requirements, and took control of the administrative apparatus to suit the interests of his own company. His Hongta Tobacco (Group) developed its own retail network and leading premium cigarette brand – 'Red Tobacco Mountain' and by 1996 had company revenue of US$2.3 billion. Although Manager Chu's formal salary was less than US$250 per month, he was eventually convicted of embezzling US$145 million in company funds (Faison, 1998). While his actions were illegal, it is an illustration of the principle that potential profits may be captured by entrepreneurial insiders.

The potential for foregone profits to be captured elsewhere in the economy can be illustrated by considering the effect on GDP. Figure 2-8 shows the composition of Chinese GDP in 2012 calculated on a value added basis. Half of GDP was labour compensation, while just under a quarter was attributed to operating surplus, which includes corporate (and SOE) profits.

Figure 2-8 Composition of GDP by value added (2012)



Source Input-Output Table from the NBS China Statistical Yearbook (2015, secs 3–21) and Finance Yearbook 2015 (China Ministry of Finance, 2015, p. 374).

SOE profits could be increased at the expense of other components of GDP. In a neutral scenario, stricter monitoring arrangements might induce the same degree of effort from SOE management and workers, while redirecting any profits over and above what is needed to incentivise the workers as profits in favour of the state owner. This would tend to increase operating surplus, but the impact on GDP would be offset by reducing the compensation of employees. GDP would be redistributed rather than created.

Negative net GDP effects are possible too. Suppose that stricter monitoring arrangements (for example, an anti-corruption campaign) have the effect of reducing the effort of SOE management and workers. This closes off channels for firm insiders to share the residual profit of the firm, so insiders begin shirking instead. The result is not higher profits, but lost output.

Achieving a positive GDP effect (rather just a redistribution of its components) depends on the removal of some underlying economic distortion. For example, if SOE labour captures some enterprise profits such that they raise their compensation above their marginal product, it could draw additional workers into the state sector and therefore drive up wage bills for competing private employers. Similarly, a lower cost of capital for SOEs can result in over-investment in capital per worker relative to non-SOEs facing a market cost of capital. This could result in inefficiently large SOEs.

Even if the state owner's declared interest is financial, it is likely to take a broader view of the economic and social impacts of its operations than would a private shareholder who is concerned only about increasing profits. The state can capture some of the downstream economic benefits through high tax receipts, and can reduce the cost of other social outlays (for example, transferring resources to workers in a depressed region). This broader view is reflected in the choice of economic value added, rather than profit, as the key management performance indicator for central SASAC SOEs (Zheng and Zhang, 2012, pp. 12–13).

Dickson (2013) shows that Party members are more concentrated in SOEs than in private business, and they demonstrate more political loyalty to the regime. Assuming a state owner in China is also an agent for the Party, it may tolerate the redistribution of income back to politically supportive SOE workers.

2.5 Conclusion

Under perfectly competitive assumptions there is, by assumption, no profit beyond the risk-free rental rate of return on capital. Profit maximisation is socially desirable (but trivial) under the competitive assumption that there are zero profits. Under these circumstances, the profitability of competing private firms may be a good benchmark against which to measure the performance of SOEs producing goods for which there is competitive market price.

Allowing for non-competitive markets, and introducing uncertainty, provides scope for positive profits. It is still the case from an efficiency perspective that the marginal return on *capital* should be equalised between uses, but this is no longer represented in 'profit' that is foregone to achieve other objectives. The potential for monopoly rents and returns to risk confound profitability as a measure.

Even in cases where an SOE's return on capital can be isolated and measured, the nature of the state owner's preferences is relevant to the assessment of the SOE's performance. In some

cases, the state owner may adopt a single explicit objective to maximise its financial returns, similar in nature to a private investor. But in many cases – particularly in those where there are social externalities from economic activity – the state owner's interest goes beyond those of the private capitalist whose primary interest is profit. It may be prepared to accept lower profits in exchange for the distribution of value elsewhere.

This could be measured elsewhere in GDP (for example, through higher employee compensation or taxes), in which case the first-round effect of redistributing capital away from SOEs (or inducing SOEs to act more like private firms) would be to redistribute income rather than to raise output. Alternatively, it could be unmeasured in GDP but nevertheless achieving policies that the state owner values. In either case, profits are foregone to achieve something of value elsewhere. A performance measure based only on missing profit is likely to over-estimate SOE inefficiency, since it fails to capture value realised elsewhere.

The performance of SOEs therefore needs to be assessed based on the nature of the SOE in question, given the market structure of the sector in which its operating and the sector-specific policy objectives. This implies that a general performance measure for 'state ownership' overall will be misleading. A careful consideration of SOEs on a sector-by-sector basis is required. To help with such a consideration, the next chapter maps state-ownership across the Chinese economy.

Chapter 3: China's mixed economy and diverse state owners

In principle, it is possible to compare performance between SOEs and non-SOEs in those markets where they directly compete. In markets that are still dominated by the state – whether because of active policy, or underlying market structures – domestic benchmarks may be missing. In which sectors of the Chinese economy do SOEs remain dominant, and where does the private sector take the lead? By examining the largest economic sectors to the smallest, the first part of this chapter shows the degree to which the prominence of the state in the Chinese economy has receded from its original dominance of the industrial sector. The chapter then projects forward to consider the future scope of state ownership in different sectors, based on current trends in fixed-asset investment.

How is state ownership distributed between different types of state owners? Large central SASAC SOEs are now globally recognisable as some of the world's largest companies, but if they are not generally representative of state capital overall, then a focus on their behaviour and performance may not be useful to judge the performance of SOEs more generally. Understanding the distribution of SOEs between the myriad central, provincial and local state owners beyond central SASAC helps understand the risks of treating State Grid or Sinopec as representative SOEs.

3.1 Sectoral distribution of SOEs in China's economy

Table 3-1 sets out China's economic sectors in order of their contribution to Chinese GDP, as measured by their value-added.[18] Before considering each of the large sectors in turn, it is worth comparing the distribution of GDP with the distribution of SOE assets (excluding state-owned banks that report through separate systems). The table shows that while the largest sector – manufacturing – accounted for a third of the value of Chinese output in 2014, it accounts for less than twenty per cent of all SOE assets (including the refining assets of the state oil conglomerates). By contrast, SOE assets are weighted heavily in 'transport, storage and post' (4.5 per cent of GDP but 16.4 per cent of SOE assets). While utilities directly contribute less than three per cent of Chinese GDP, they account for almost ten per cent of SOE assets (including the large electricity companies) and are important upstream industries that influence output across the economy. Over a quarter of total SOE assets fall into either 'Government,

[18] Some NBS categories are consolidated to allow comparison with Ministry of Finance SOE data – 'Wholesale and Retail Trade' is consolidated with 'Accommodation and Catering'.

NGO or Other' and social services sectors,[19] which combined account for only five per cent of GDP.

Table 3-1 Value-added by industry, and distribution of SOE assets (2014)

		Percentage share of	
	GDP	GDP ex Finance	SOE Assets
Industry – Manufacturing	31.2	33.7	18.5
Wholesale, retail, accommodation and catering	11.7	12.7	5.4
Primary	9.3	10.1	0.9
Finance	7.4		
Construction	7.2	7.7	7.1
Real Estate, Leasing and Commercial Service	6.1	6.5	9.8
Transport, Storage and Post	4.5	4.9	16.4
Education, Culture and Broadcasting	4.1	4.4	0.6
Government, NGO and Other	3.8	4.1	10.7
Industry – Mining	3.7	4.0	3.2
IT, Computer Service and Software	2.5	2.7	0.2
Industry – Utilities	2.4	2.6	9.4
Health, Sports, and Welfare	2.0	2.2	0.1
Scientific Research and Technical Services	2.0	2.1	1.0
Social Services	1.5	1.7	16.2
Geological Exploration and Water Conservancy	0.6	0.6	0.5
Total	100.0		
Total: ex Finance		100.0	100.0

Source GDP value-added shares calculated from China NBS (2016, secs 3–6), SOE assets shares from China Ministry of Finance (2015, sec. 384).

The remainder of this section considers the extent of state ownership in each of these economic sectors, in declining order of their contribution to China's GDP. In total, sectors for which official aggregate statistical reporting on ownership of assets or output exists covered 77 per cent of the Chinese economy in 2014.

3.1.1 Industry – Manufacturing

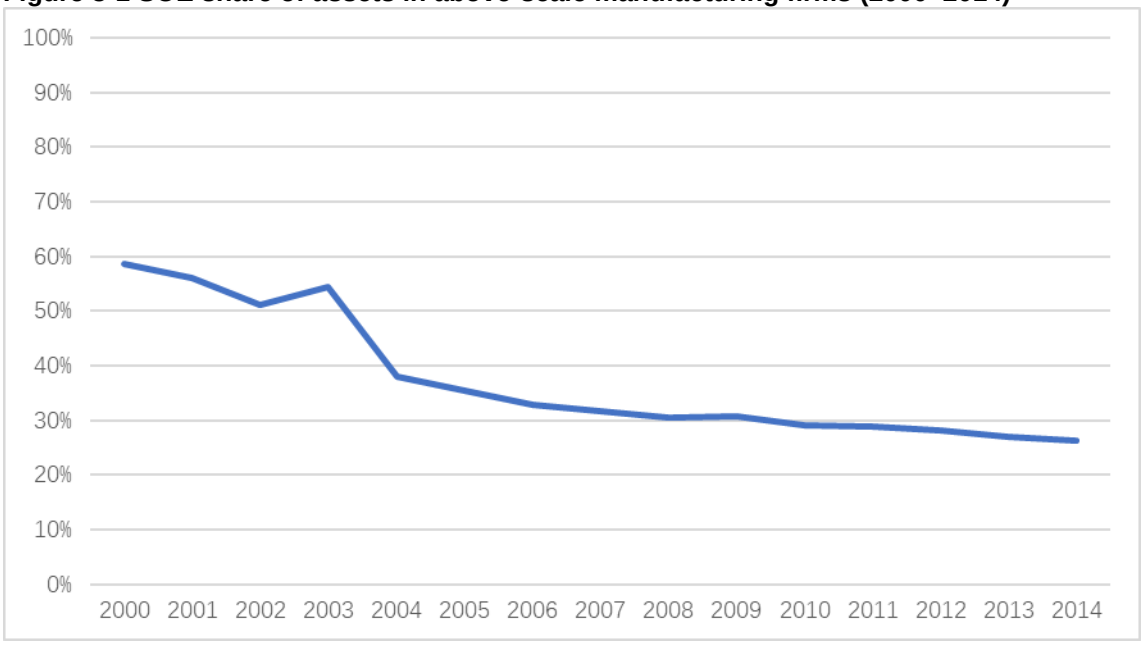
Manufacturing accounted for 31 per cent of GDP in 2014. The distribution of state ownership in manufacturing, as well as a comprehensive survey of market concentration in manufacturing will be considered in the next chapter. The performance of SOEs in manufacturing sectors is then further covered in Chapter 5.

Here it is sufficient to observe that the SOE share of manufacturing assets has declined steadily for at least a decade. Figure 3-1 shows the relative decline of SOEs from manufacturing; in 2000 SOEs controlled just under sixty per cent of manufacturing assets; by 2014 the share

[19] This includes amongst other things, aged care homes, services for the disabled and for communities, and funeral homes (National Bureau of Statistics of China, 2016, secs 22–20).

controlled by SOEs was less than thirty per cent. The state is fading from most manufacturing, even as vestiges of state ownership remain in each (Naughton, 2017, p. 286).

Figure 3-1 SOE share of assets in above-scale manufacturing firms (2000–2014)



Source Author's calculations based on NBS Statistical Yearbook (various years)

The decline of SOEs is even starker when focusing on internationally traded goods (Lardy, 2014, pp. 86–88). In 2014 China was the world's largest merchandise exporter, with goods exports valued at US$2.3 trillion, of which 95 per cent was manufactured goods (World Trade Organization, 2015, p. 44,89). Table 3-2 shows that the SOE share of industrial exports (including manufacturing) fell from 12 per cent in 2005 to 8 per cent in 2014.

Table 3-2 Value of Chinese exports (2005–2014)

	Value of export delivery of above-scale industrial enterprises (Billion RMB)	Of which state-controlled	Per cent
2005	4,774.1	554.3	12
2006	6,056.0	598.1	10
2007	7,339.3	721.8	10
2008	8,249.8	868.4	11
2009	7,205.2	602.3	8
2010	8,991.0	772.5	9
2011	9,961.2	870.1	9
2012	10,661.0	866.9	8
2013	11,282.4	879.2	8
2014	11,841.4	931.4	8

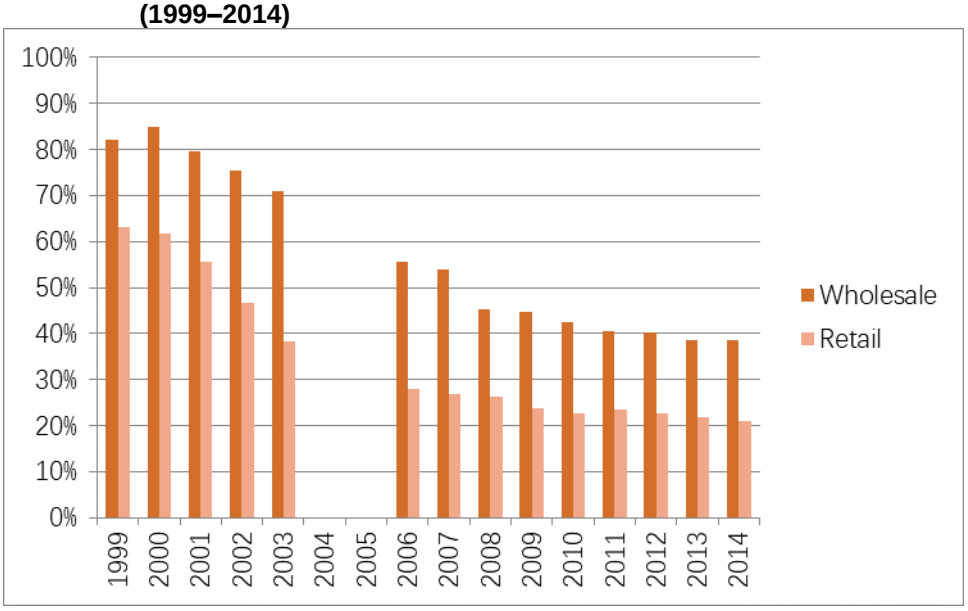
Source Author's calculations based on NBS Statistical Yearbook (various years)

Even with the declining relative importance of SOE manufacturers, thousands of (particularly local) SOEs remain in competitive manufacturing sectors (Lardy, 2014, p. 141). By contrast, SOEs in manufacturing sectors are relatively rare in advanced economies – the OECD's 2012 survey of OECD and partner countries (not including China) identified 185 manufacturing SOEs out of 2,111 SOEs in total, which accounted for just 1.7 per cent of total SOE value (OECD, 2014, pp. 14–15).

3.1.2 Wholesale and Retail Trade, Accommodation and Catering

Figure 3-2 shows that the share of revenue held by SOEs in wholesale and retail sectors (the largest sector after manufacturing, at ten per cent of GDP) has more than halved for each since 1999, with the state share of retail being half that of wholesale.

Figure 3-2 Revenue share of state-controlled wholesale, retail enterprises (1999–2014)



Source NBS, domestic trade and household survey, accessed through CEIC China Premium Database. 2004, 2005 data are unavailable.

Accommodation and catering account for a further two per cent of GDP. Within catering, the state-controlled share of revenue fell from 33 per cent in 2000 to five per cent in 2014 (CEIC China Premium Database, Domestic Trade and Household Survey). In hotels the number of (formally registered) state-owned star-rated hotels has more than halved in absolute terms from 5,832 out of 12,731 star-rated hotels in 2006 (Ministry of Culture and Tourism of the People's Republic of China, 2015) to 2,426 out of 12,327 star-rated hotels in 2015 (Ministry of Culture and Tourism of the People's Republic of China, 2017).

3.1.3 Primary Industry

The third largest sector (nine per cent of GDP) includes agriculture, forestry and fishing. As noted in Section 1.2.1, the agricultural sector was heavily influenced by state policies but not

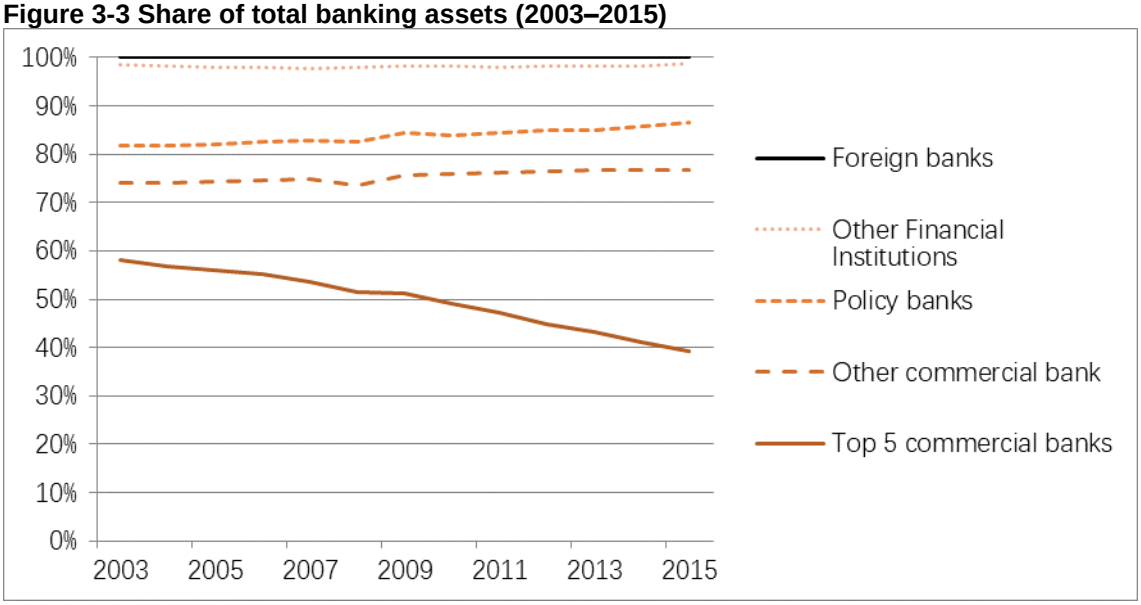
formally state owned. Fewer than 2,000 state farms trace their origins to the 1950s (Lardy, 2014, p. 62), which by 2014 accounted for less than one per cent of SOE assets.

3.1.4 Finance

The state remains the leading player in the fourth largest sector, financial intermediation (seven per cent of GDP). Five large commercial banks are partially owned, either directly or indirectly by the Chinese Ministry of Finance, and are the largest financial intermediaries in China. Of these, the 'Big Four' (Naughton, 2007b, pp. 455–456) were spun off from the People's Bank of China between 1979 and 1983. The Agricultural Bank of China was re-established to serve rural customers, the Bank of China was created to specialise in foreign exchange, and the Constitution Bank of China was created to finance fixed asset investment. The remaining savings and loans business was transferred to the Industrial and Commercial Bank of China (Wu, 2005, p. 220; Lardy, 2014, p. 31). The fifth large commercial bank is the Bank of Communications. Its mainland operations had originally been merged with the People's Bank in 1958, but it was re-established in 1987 by the State Council as a commercial bank headquartered in Shanghai (Bank of Communications, 2018).

Although these five banks remain dominant, Figure 3-3 shows that their total share of Chinese banking assets declined from 58 to 39 per cent between 2003 and 2015. China's other commercial and policy banks and financial institutions are also substantially state owned, but not necessarily at the central government level. Chang (2001) argued that foreign competition as part of China's WTO accession would fundamentally reshape the China's financial system, and with it the Chinese political-economy. Yet the share of assets held by foreign banks in China stubbornly remains around two per cent (Lardy, 2014, pp. 20–21).

Figure 3-3 Share of total banking assets (2003–2015)



Note Other commercial banks include shareholding commercial banks, city commercial banks and rural commercial banks.

Source Author's calculation based on China Banking Regulatory Commission accessed through CEIC China Premium Database.

3.1.5 Construction

Construction is the fifth largest sector in the national accounts (seven per cent of GDP). Here the state remains dominant, although Table 3-3 shows that the state share of both revenues and profits declined from around four fifths in 2003 to around two thirds in 2014.

Table 3-3 Share of domestic-non-private construction activity (2003–2014)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Assets									74.8	75.0		73.8
Revenue	86.0	80.5	80.2	77.5	76.7	74.5	75.6	74.4	73.5	72.5		70.6
Profit	78.5	70.8	71.9	67.9	70.5	67.6	67.7	66.2	65.8	66.2	65.1	64.9

Source Author's calculation based on NBS, Construction Activity Indicator, accessed through CEIC China Premium Database.

It is difficult in this sector to disentangle SOE performance from the efficiency of state spending more generally. Over this period, between a quarter and a third of the revenue of construction companies was for civil engineering projects. Given this is a state-dominated sector, it is associated with popular perceptions of China 'over investing' in unproductive infrastructure (for example, international airports or super highways well beyond current needs). However, the question of whether the government is spending on valuable assets should be separated from whether SOEs are an efficient method of producing those assets.

If a particular local government in China expands infrastructure it is likely that the construction activity will be carried out by an SOE. Although the plan itself may be an entirely non-productive piece of infrastructure, the SOE might carry it out efficiently, in which case the problem lies with the state's manner of project selection and budgeting rather than state ownership. By contrast, if the state-owned construction company is responsible for delivering what should be a highly productive piece of infrastructure, but is unable to control costs or deliver quality output to the same extent as a private firm, then there is a case for identifying state ownership as the culprit of inefficiency.

3.1.6 Real Estate

The real estate sector now accounts for six per cent of GDP, and ten per cent of SOE assets. Under the planned economy, capital for urban housing was financed by the central government, and then allocated and maintained by work units and municipalities. The first experiments with housing markets took place in Xi'an in 1979, before the large-scale privatisation took off with the National Housing Reform Plan in 1988. SOEs and local work units finally abandoned the provision of housing in 1998, by which time the housing market was more or less privatised

(Gibson, 2009). But while SOEs have played an active and opportunistic role in real estate development (Deng *et al.*, 2015), they are not dominant.

3.1.7 Industry – Mining

Mining (primarily coal, oil and gas) and quarrying accounted for four per cent of GDP in 2014. This is another sector that is dominated by SOEs, although the SOE share of mining assets has declined from more than 90 per cent in 2000 to around 70 per cent by 2014.

Coal mining is the largest of these subsectors, with a long history of state ownership. From 1949 to 1988 the entire Chinese coal industry was organised by a single ministry and divided into state-owned mines under the central government, with local state mines under provincial, county or prefectural governments, and 'local non-state' mines operated by townships, communes, collectives or the Army (Thomson, 2003, p. 28). Subsidisation, if not outright nationalisation, of coal is by no means unique to China – the British coal industry was nationalised in 1946. Coal also received ongoing government subsidies in the United States, Japan and Germany even into the 1980s (Thomson, 2003, p. 77).

During the 1980s and 1990s, coal faced both increasing competition from TVEs and also heavy price regulation. The policy objective was not to maintain high profits for SOEs but to ensure low costs for downstream energy users (Wright, 2000). Nevertheless, performance can be assessed through careful estimates of technical efficiency to measure the differences between different ownership types while controlling for geography. For example, using a stochastic production frontier technique (Zhao, 1994; Kalirajan and Zhao, 1997; Coelli, Rao and Battese, 1998), Shi and Grafton (2010) estimate that state-owned coal mines in China were significantly less technically efficient than collectives or privately owned mines between 2000 and 2005.

Although mining accounts for only three per cent of SOE assets, the state coal industry accounts for a disproportionate share of SOE employment. Of the 18 million employees of industrial SOEs in 2014, 3.2 million were employed in coal SOEs (China Ministry of Finance, 2015, p. 391) – virtually unchanged over ten years.

3.1.8 Industry – Utilities

The utility sector covers the distribution and production of electricity, heat, gas and water. While only two per cent of GDP, this sector accounts for nine per cent of SOE assets. The SOE share of assets in this sector was relatively constant at 90 per cent from 2000 to 2014, although limited private sector operations have occurred in the city gas business (Lardy, 2014, pp. 76–78). The economic characteristics of network utilities, and the case for state ownership in the case of naturally monopolistic sectors, were discussed in the previous chapter.

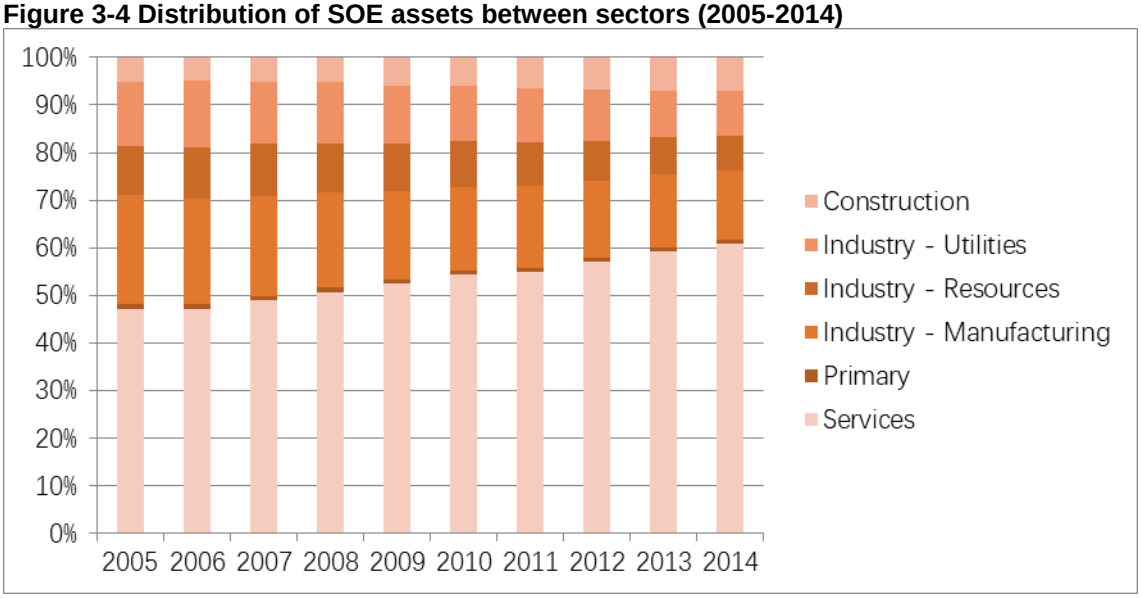
3.1.9 Other Sectors

Reliable measures of either assets or output are not available in other sectors such as transport, storage and post, public administration, health, education and utility management (which account for a further 13 per cent of output). Market reforms in these sectors lagged the reform and opening up of these sectors – the Ministry of Post and Telecommunications monopolised telecommunications into the 1990s (Naughton, 2007b, p. 343). Despite corporatisation and some market reforms, these are sectors where state ownership remains important (Naughton, 2017, p. 286). The next section will show that many large central SOEs operate in the transport and telecommunications sectors.

The final nine per cent of Chinese output covers less established and newer service sectors such as information technology services, leasing and commercial services, scientific research, culture, sport and entertainment and other services, which either did not exist or were not a focus of economic development under the old economy. As per capita incomes rise in China they are likely to become more important (Hubbard, Hurley and Sharma, 2012), but the relative growth in the services sector creates something of a blind spot for the study of SOEs.

Figure 3-4 shows that the distribution of SOE assets has been shifting – the services share grew from less than half in 2005 to more than 60 per cent in 2014. This shift is confirmed by the 2013 Decision which pledged to ‘ensure state-owned capital increases its input into public-welfare enterprises and make greater contributions in the provision of public services’ (Communist Party of China, 2014). These sectors are related to social services such as hospitals, kindergartens, museums, publishing houses, schools and universities (Brødsgaard, 2014, pp. 6–7). To the extent that the value created in these sectors cannot be captured in competitive market prices for the goods and services that they produce, profit will be a poor measure for assessing the performance of SOEs in these sectors.

Figure 3-4 Distribution of SOE assets between sectors (2005-2014)



Source (China Ministry of Finance, 2015, p. 384)

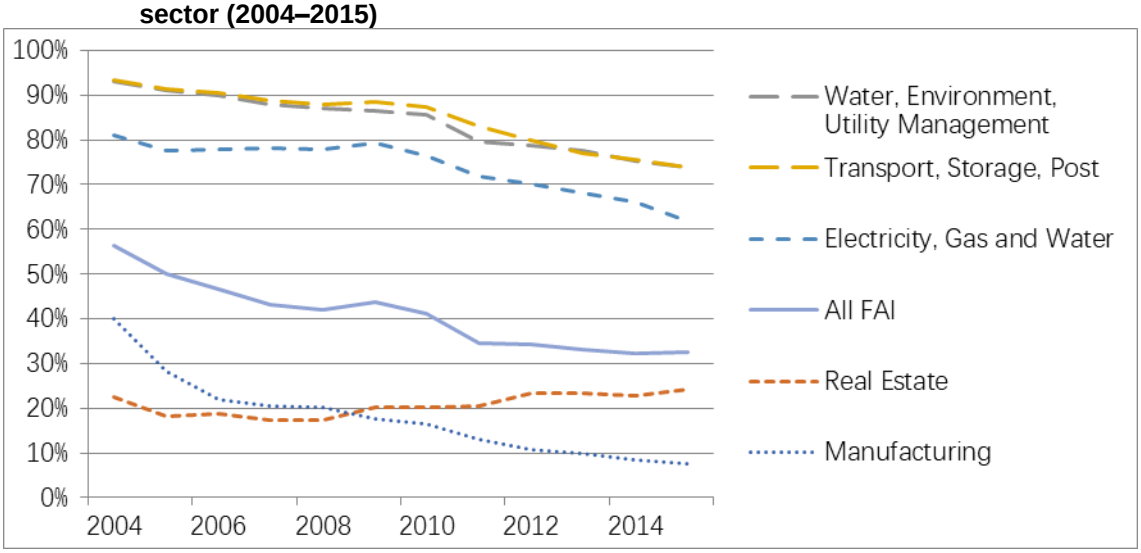
While the industrial sectors (mining, manufacturing and utilities) are covered by comprehensive annual statistics, the newer services sector has grown rapidly without commensurate statistical coverage (Lardy, 2014, p. 79). Whether these are newly-created SOEs, or existing government services restructured in a new enterprise form, benchmarking against industrial SOEs' performance might not be particularly informative.

3.2 Projected distribution based on state share of fixed asset investment

While comprehensive data on Chinese output by ownership is not available across all economic sectors, comprehensive statistics on fixed asset investment by ownership type are available (Lardy, 2014, pp. 117–119). They provide a leading indicator of the role of the state in economic output. The main limitation is that such data may understate the role of the state in sectors that are less dependent on fixed asset investment (such as finance, which accounts for seven per cent of GDP but only 0.2 per cent of fixed asset investment).

Figure 3-5 shows the declining role of the state in fixed asset investment from 56 per cent in 2004 to 32 per cent by 2015. Of the five major sectors that collectively accounted for 80 per cent of fixed asset investment between 2004 and 2015, the state's share fell significantly for all sectors except real estate.

Figure 3-5 Share of fixed asset investment by state-controlled enterprises, by sector (2004–2015)



Source Author's calculation based on NBS, Domestic Investment Indicator accessed through CEIC China Premium Database.

The small surge in SOE investment in 2009 can be attributed to China's infrastructure-heavy stimulus response to the GFC (McKissack and Xu, 2011). The stimulus is sometimes portrayed as loose spending on behalf of SOEs at the behest of the state (Kowalski *et al.*, 2013; Deng *et al.*, 2015). But the National Development and Reform Commission Chairman's pronouncement that 'no ordinary manufacturing projects would get money' (Wang, 2009) is borne out in the aggregate statistics – the SOE share of manufacturing investment continued to fall in 2009. Instead, the temporary uptick in the state share of total fixed asset investment suggests a temporary shift in the composition of investment toward infrastructure sectors that are state-owned, rather than an attempt to boost the investment of SOEs in general.

Table 3-4 shows that by 2014 the state undertook around a third of fixed asset investment. In the manufacturing sector the share of fixed asset investment by state enterprises had fallen to just eight per cent.

Table 3-4 SOE fixed-asset investment (2014)

Sector	Total (Million RMB)	Of which state	State Share (%)
Industry – Manufacturing	18,023,340.2	1,379,937.8	8
Real Estate	12,670,615.7	3,073,478.6	24
Water Conservancy, Environment and Utility Management	5,567,903.4	4,104,725.5	74
Transport, Storage and Post	4,897,481.1	3,611,447.7	74
Industry – Utilities	2,670,962.8	1,651,884.7	62
Primary Industry	1,906,231.6	448,149.3	24
Wholesale and Retail Trade	1,868,142.5	163,549.8	9
Industry – Mining	1,297,021.8	580,526.8	45
Leasing and Commercial Service	943,583.1	273,972.9	29
Public Administration and Social Organization	785,091.8	571,064.5	73
Education	772,324.2	556,974.9	72
Culture, Sport and Entertainment	672,412.0	276,776.6	41
Accommodation and Catering	650,422.6	83,233.0	13
Information Transmission, Computer Service and Software	551,637.0	264,513.9	48
Health Care, Social Security and Welfare	517,469.0	313,122.8	61
Construction	489,670.1	263,916.0	54
Scientific Research	475,154.0	146,930.0	31
Other Service	262,816.2	64,608.5	25
Financial Intermediation	136,724.9	64,492.3	47
Total	55,159,003.8	17,893,305.6	32

Source Author's calculation based on NBS, Domestic Investment Indicator accessed through CEIC China Premium Database.

The future state share of output can be projected by considering the contribution of different sectors to GDP today, and the state's share in investment in each of these sectors. On the basis of GDP sector weights and the SOE share of fixed asset investment in 2007, Szamosszegi and Kyle (2011) estimated an implied long-run state share of value added of around 40 per cent. This is roughly double the average share of government production in GDP from the OECD of 21.5 per cent (OECD, 2016b).

Table 3-5 shows the same calculation based on the changes in GDP and fixed asset investment shares up to 2014, to provide a long-run estimate of 30 per cent. While still much higher than an OECD average, it is well within the range of government production shares in France (27.6), Iceland (27.8), the Netherlands (29.9), Sweden (30.3), Denmark (30.5) and Finland (31.6) (OECD, 2016b). It projects that the state will remain concentrated in sectors where state intervention and involvement is not unusual in a mixed economy, including transport, education, health and construction.

Table 3-5 Implied state percentage share of long-run GDP

Sector	(A) GDP share	(B) State FAI share	(A) x (B) = implied long-run state percentage share of GDP
Industry – Manufacturing	30	8	2
Wholesale and Retail Trade	10	9	1
Primary Industry	9	24	2
Construction	7	54	4
Financial Intermediation	7	47	3
Real Estate	6	24	1
Transport, Storage and Post	4	74	3
Public Administration and Social Organization	4	73	3
Industry – Mining	4	45	2
Education	3	72	2
Industry – Utilities	2	62	1
Health Care, Social Security and Welfare	2	61	1
Information Transmission, Computer Service and Software	2	48	1
Leasing and Commercial Service	2	29	1
Scientific Research	2	31	1
Other Service	2	25	0
Accommodation and Catering	2	13	0
Water Conservancy, Environment and Utility Management	1	74	0
Culture, Sport and Entertainment	1	41	0
Gross Domestic Product	100	0	30

Source Author's calculation based on NBS, Domestic Investment Indicator and accessed through CEIC China Premium Database, and GDP value-added shares calculated from NBS (2016, secs 3–6)

3.3 Diverse state owners[20]

Part of the reason for the emphasis on China's state sector has been that many of the largest Chinese companies, particularly those that have become large overseas investors are SOEs. Between 2005 and 2014, the number of Chinese SOEs included on the Global Fortune 500 increased from 14 to 76 (Kwiatkowski and Augustynowicz, 2015). Table 3-6 shows that 44 of China's 50 largest corporations in 2013 were SOEs. These top 50 companies account for just under half (US$4.3 trillion) of the revenue for China's 500 largest companies that year (US$9.2 trillion). Where do these fit into the state system? What is the nature of these companies – and how do those that are administered by the central government (see section 3.3.1) compare to those administered by local governments (section 3.3.2)?

[20] This section is derived in part from Hubbard and Williams (2017), copyright Inderscience Publishers: http://dx.doi.org/10.1504/IJPP.2017.10006452.

Table 3-6 Fifty largest Chinese enterprises by revenue (2013)

#	Group or Company Name	Billion RMB	Billion USD	Controlling agency
1	China Petroleum & Chemical Corporation (Sinopec)	2,945.1	475.7	Central SASAC
2	China National Petroleum Corporation (CNPC)	2,759.3	445.7	Central SASAC
3	State Grid Corporation of China	2,049.8	331.1	Central SASAC
4	Industrial and Commercial Bank of China Limited (ICBC)	925.6	149.5	Central Other
5	China Construction Bank Corporation (CCB)	771.0	124.5	Central Other
6	Agricultural Bank of China	706.3	114.1	Central Other
7	China State Construction Engineering Corporation	681.0	110.0	Central SASAC
8	China Mobile Communications Corporation (CMCC)	661.9	106.9	Central SASAC
9	Bank of China Limited (BOC)	649.4	104.9	Central Other
10	China National Offshore Oil Corporation (CNOOC)	590.1	95.3	Central SASAC
11	China Railway Construction Corporation Limited	588.7	95.1	Central SASAC
12	SAIC Motor Corporation Limited	565.8	91.4	Provincial SASAC
13	China Railway Group Limited	560.4	90.5	Central SASAC
14	ChinaLife Insurance Company Ltd.	497.5	80.4	Central Other
15	Sinochem Group	466.9	75.4	Central SASAC
16	FAW Group Corporation	461.2	74.5	Central SASAC
17	Dongfeng Motor Corporation	455.0	73.5	Central SASAC
18	China Southern Power Grid Co., Ltd.	447.0	72.2	Central SASAC
19	China Development Bank	439.0	70.9	Central Other
20	Ping An Insurance (Group) Company of China	415.5	67.1	Provincial Other
21	China Minmetals Corporation	414.7	67.0	Central SASAC
22	China Resources (Holdings)Co., Ltd	405.5	65.5	Central SASAC
23	China North Industries Group Corporation	385.3	62.2	Central SASAC
24	China Telecom Corp. Ltd.	381.5	61.6	Central SASAC
25	CITIC Group	375.1	60.6	Central Other
26	Shenhua Group Corporation Limited	367.8	59.4	Central SASAC
27	China Pacific Construction Group Limited	366.6	59.2	Private
28	China Post	362.5	58.6	Central Other
29	China South Industries Corporation Group	361.8	58.4	Central SASAC
30	Aviation Industry Corporation of China	349.4	56.4	Central SASAC
31	Tianjin Material & Equipment Group Corporation	337.9	54.6	Provincial SASAC
32	China Communications Construction Group	335.8	54.2	Central SASAC
33	People's Insurance Company (Group) of China	304.7	49.2	Central Other
34	China United Network Communications Corporation Ltd	304.7	49.2	Central SASAC
35	Bao Steel Group Corporation	303.1	49.0	Central SASAC
36	Bank of Communications	296.5	47.9	Central Other
37	China Huaneng Group	293.2	47.4	Central SASAC
38	Suning Corporation	279.8	45.2	Private
39	China Aluminum Corporation	279.4	45.1	Central SASAC
40	Beijing Automotive Industry Holding Co., Ltd.	266.4	43.0	Provincial SASAC
41	China National Building Materials Group Corporation	252.3	40.7	Central SASAC
42	Greenland Group	252.2	40.7	Provincial SASAC
43	Hebei Iron & Steel Group Co. Ltd	251.0	40.6	Provincial SASAC
44	China National Chemical Corporation	244.0	39.4	Central SASAC
45	Lenovo Holdings Ltd.	244.0	39.4	Private
46	China National Machinery Industry Corporation	242.4	39.2	Central SASAC
47	Shandong Weiqiao Pioneering Group Co..Ltd	241.4	39.0	Private
48	Huawei Technologies Co Ltd	239.0	38.6	Private
49	Shanxi Coking Coal Group Co., Ltd.	236.1	38.1	Provincial SASAC
50	Amer International Group	233.8	37.8	Private

Source China Top 500 Enterprises list (China Enterprise Confederation/China Enterprise Directors Association, 2014), China Top 500 Private Enterprises 2014 list (Sina, 2014), firm ownership information from central and local SASAC websites, central Huijin website and annual reports.

There are some very large enterprise groups under the control of the central government, such as the national electricity grid, State Grid Corporation, and the two oil giants, Sinopec and CNPC. These SOEs are the parent companies for much larger corporate groups. It is these large enterprise groups that have gained global prominence in the Fortune 500 and large-scale overseas investment (Luo, Qi and Hubbard, 2017).

Amongst the 44 largest SOEs, 37 were under the direct administration of the central government, and seven SOEs are under the direct administration of local state agencies. For two thirds of all of these, including China's key industrial conglomerates in electricity, oil, minerals, telecommunications and leading heavy-manufacturing firms, the central government is represented by central SASAC. Of the 161,000 SOEs and subsidiaries enumerated in the 2015 Finance Yearbook (China Ministry of Finance, 2015), 54,000 come under the jurisdiction of the central government. The remaining 106,000 are administered at provincial level and below.

Although the largest and most prominent SOEs are administered at the central level, more than half of SOE assets were controlled below central level by 2015, as shown in Table 3-7.

Table 3-7 Total of SOE assets by supervising authority (Billion RMB)

	2008	2009	2010	2011	2012	2013	2014
Central-SASAC	17,360.7	20,976.0	24,321.8	27,972.8	31,337.7	34,941.9	38,625.9
Central-Other	5,599.7	6,934.1	8,709.7	10,434.8	12,074.2	13,653.0	15,351.7
Local	20,351.0	25,514.3	30,989.9	37,500.7	46,077.1	55,499.9	64,494.0
Total	43,311.4	53,424.4	64,021.4	75,908.2	89,489.0	104,094	118,471
Central SASAC (%)	40	39	38	37	35	34	33
Central Other (%)	13	13	14	14	13	13	13
Local (%)	47	48	48	49	51	53	54

Source Author's calculation based on Finance Yearbook (China Ministry of Finance, 2015, pp. 381–383)

3.3.1 Central state owners

Table 3-8 shows that there are 823 SOEs that report directly to central government ministries, commissions, administrations and bureaux. Aside from central SASAC and the Ministry of Finance, there are 26 central government ministries, agencies and affiliated bodies that supervise 698 other central SOEs.

Table 3-8 Number of SOEs under direct central supervision (2015)

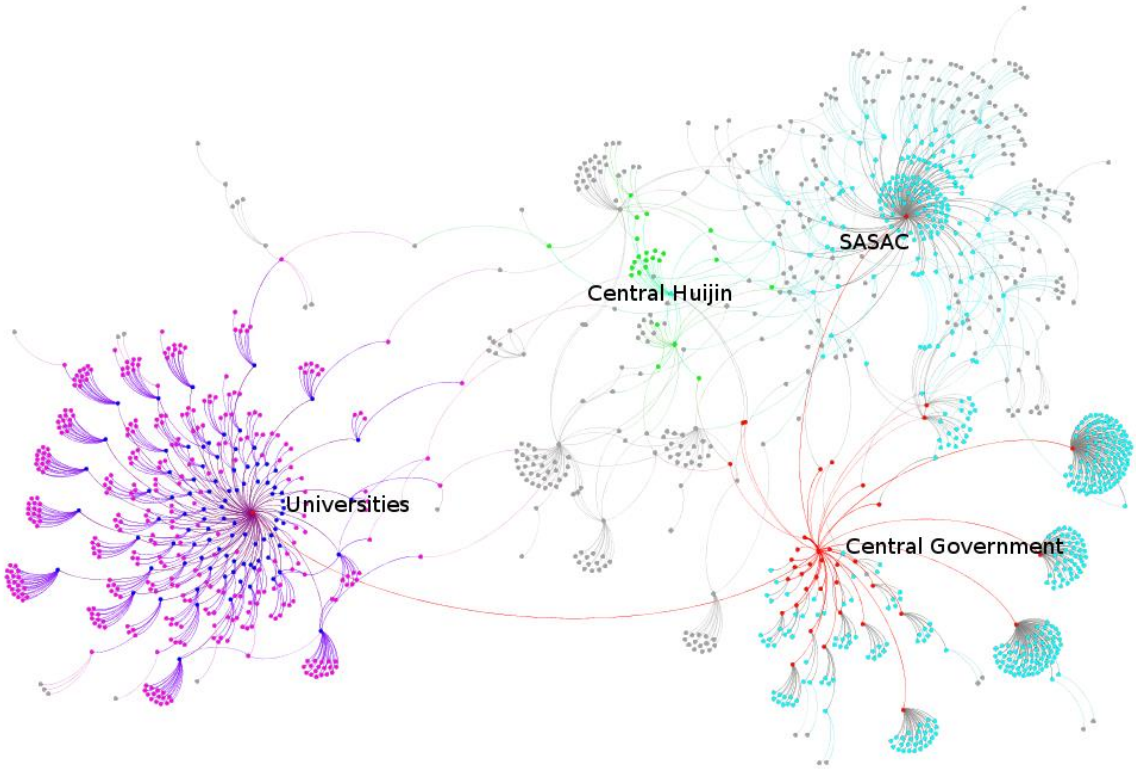
Ministries and Commissions under the State Council:	599		
Ministry of Education		372	
Fudan University			21
Tianjin University			21
East China Normal University			15
Shanghai International Studies University			15
Nankai University			14
Beijing Normal University			13
Sun Yat-sen University			13
Shanghai Jiaotong University			11
Sichuan University			10
Ocean University of China			10
83 other universities with fewer than ten SOEs			229
Ministry of Finance		114	
China National Tobacco Corporation			1
China Post			1
China Railway Corporation			1
Central Cultural Enterprises under the supervision of Ministry of Finance			111
Ministry of Industry and Information Technology		73	
Ministry of Culture		10	
Ministry of Water Resources		8	
National Health and Family Planning Commission		7	
Ministry of Agriculture		5	
Ministry of Civil Affairs		5	
Ministry of Environmental Protection		4	
Ministry of Justice		1	
State-owned Assets Supervision and Administration Commission	114		
Organizations directly under the State Council	54		
General Administration of Sport		49	
National Tourism Administration		2	
China Food and Drug Administration		1	
State Forestry Bureau		1	
State Administration of Press, Publication, Radio, Film and Television		1	
Administrations and bureaux under ministries and commissions	14		
Civil Aviation Administration of China		9	
State Cultural Relics Bureau		2	
State Oceanic Administration		2	
State Administration of Traditional Chinese Medicine		1	
Other	42		
China Council for the Promotion of International Trade		29	
China Federation of Literary and Art Circles		5	
Communist Youth League		3	
Supreme People's Procuratorate		2	
Government Offices Directly under the Central Committee		2	
Government Offices of the State Council		1	
Total	823		

Source Author's deconstruction of Central State Capital Budget Reporting System (China Ministry of Finance, 2016)

The relationships of central state agencies to these SOEs, and also their listed subsidiaries (including joint ventures) are illustrated in Figure 3-6. The ministries, commissions and other agencies of the central government are illustrated as red nodes, emanating from the "central government" node next to the corresponding label in the bottom, right of the diagram. Central SASAC is one of these commissions, marked as a red node in the top right of the diagram. The cyan nodes coming from this SASAC node are central SASAC SOEs (to be introduced in the next subsection). Other cyan nodes are SOEs of other central ministries and agencies (to be introduced in Subsection 3.3.1.2). Light green dots are SOE subsidiaries of Central Huijin, a holding company for China's most important financial system players. On the left-hand side of the diagram, the dark blue nodes represent universities under the jurisdiction of the Ministry of Education. The magenta nodes indicate SOEs that are subsidiary of those universities.

The grey nodes are publicly-listed subsidiaries of SOEs on China's two domestic stock exchanges. Where there are multiple edges leading to more than one parent, this indicates publicly-listed SOEs that are partially owned by more than one SOE parent. For example, financial SOEs owned by 'Central Huijin' may also have a stake in listed university-SOEs (populating the space to the left of 'Central Huijin') or Central SASAC SOEs (to the right).

Figure 3-6 Central government SOEs and their listed subsidiary companies



Source Created by author using Gephi is an open-source network analysis and visualisation software package, based on Ministry of Finance (2016), and 'ultimate controlling owner' of listed companies on Shenzhen and Shanghai Stock Exchanges.

3.3.1.1 Central SASAC SOEs

Table 3-9 shows that 30 per cent of the SOE assets under the control of central SASAC sit inside three Chinese oil companies, State Grid (the monopoly electricity distributor for 88 per cent of China), and China Mobile (China's largest telecommunications company). The smallest 56 central SASAC SOEs have a combined total asset value equivalent to that of State Grid.

Table 3-9 Largest central SASAC SOEs by total asset value (2014)

#	Central SOE Name	Billion RMB	Billion USD	(%)	Cum (%)
1	China National Petroleum Corporation	3,939.4	641.3	10	10
2	State Grid Corporation of China	2,892.9	470.9	7	18
3	China Petroleum &. Chemical Corporation	2,228.4	362.8	6	23
4	China Mobile Communications Corporation	1,530.8	249.2	4	27
5	China National Offshore Oil Corporation	1,119.4	182.2	3	30
6	China Resources (Holdings) Co, Ltd	934.6	152.2	2	33
7	Shenhua Group Corporation Limited	928.6	151.2	2	35
8	China Huaneng Group	928.2	151.1	2	37
9	China State Construction Engineering Corporation	923.9	150.4	2	40
10	Aviation Industry Corporation of China	799.6	130.2	2	42
11	China Guodian Corporation	787.1	128.1	2	44
12	China Huadian Corporation	726.6	118.3	2	46
13	China Datang Corporation	720.4	117.3	2	47
14	China Telecommunications Corporation	700.3	114.0	2	49
15	China Railway Engineering Corporation	685.4	111.6	2	51
16	China Power Investment Corporation	680.4	110.8	2	53
17	China Grain Reserves Corporation	678.8	110.5	2	55
18	China Communications Construction Company, Ltd	661.9	107.8	2	56
19	China Railway Construction Corporation	630.1	102.6	2	58
20	China Merchants Group	624.2	101.6	2	59
21	China Southern Power Grid Co, Ltd	617.0	100.4	2	61
22	China United Network Telecommunications Group Corp	591.7	96.3	2	63
23	China Poly Group Corporation	550.9	89.7	1	64
24	Baosteel Group Corporation	534.7	87.0	1	65
25	Aluminum Corporation of China Limited	486.5	79.2	1	67
26	China Three Gorges Project Corporation	475.5	77.4	1	68
27	State Development & Investment Corp	461.7	75.2	1	69
28	COFCO Corporation	439.8	71.6	1	70
29	China Power Construction Corporation	413.2	67.3	1	71
30	China Shipbuilding Industry Corporation	412.7	67.2	1	72
31	China National Building Material Group Corporation	406.9	66.2	1	73
32	China National Nuclear Corporation	394.6	64.2	1	74
33	China Guangdong Nuclear Power Corporation	388.9	63.3	1	75
34	China Minmetals Corporation	366.1	59.6	1	76
35	China Ocean Shipping (Group) Company	359.1	58.5	1	77
36	Sinochem Corporation	355.4	57.8	1	78
37	China Metallurgical Group Corporation	338.8	55.1	1	79
38	China South Industries Group Corporation	334.9	54.5	1	80
39	China Aerospace Science and Technology Corporation	328.9	53.5	1	81
40	China FAW Group Corporation	328.7	53.5	1	82
	Other enterprises with above-median assets: 17	4,145.8	674.9	*11*	*11*
	Enterprises with below-median assets 56	3,015.8	491.0	*8*	*18*
	All Central SASAC SOEs	38,868.4	6,327.5	100	

Source Author's calculation based on SASAC General Affairs Bureau (2016)

Central SASAC companies and their subsidiaries employed 12.8 million workers in 2014 (SASAC, 2016, p. 1). Half of these were employed by just ten SOEs. By contrast, the smallest central SOEs such as China Travelsky Holding Company, China National Arts & Craft (Group), the China National Cotton Reserves Corporation and the China National Silk Import & Export Corporation each employ no more than a few thousand workers.

Table 3-10 shows that the distribution of financial returns from central SOEs is even more concentrated in a handful of large SOEs. Seven central SOEs produced half of the 515 billion RMB (US$83.8 billion) accounting profits in 2014 for central SASAC SOEs. Notably the three oil companies are not only the most profitable, but pay 42 per cent of the total taxes of central SOEs, due to the significant resource rents they can extract. Total central SASAC SOE losses amounted to just four per cent of profits, showing that the sector as a whole was profitable. Losses were concentrated in resource companies, the largest loss maker being the Aluminum Corporation of China (Chinalco).

Table 3-10 Largest profits and losses amongst central SASAC SOEs (2014)

Central SOE Name	Profit or Loss			Tax Revenue		
	RMB billion	USD billion	Share (%)	RMB billion	USD billion	Share (%)
China National Petroleum Corporation	123.8	20.2	13	427.8	69.6	21
China Mobile Communications Corporation	94.1	15.3	10	72.3	11.8	4
China National Offshore Oil Corporation	79.2	12.9	8	129.7	21.1	6
State Grid Corporation of China	62.4	10.2	6	138.3	22.5	7
Shenhua Group Corporation Limited	48.4	7.9	5	58.1	9.5	3
China Petroleum &. Chemical Corporation	45.1	7.3	5	309.5	50.4	15
China FAW Group Corporation	44.6	7.3	5	75.5	12.3	4
Other Profitable SOEs – 97	*515.0*	*83.8*	*53*	*806.2*	*131.2*	*39*
Loss Making SOEs – 9	*-35.5*	*-5.8*	*-4*	*33.2*	*5.4*	*2*
Aluminum Corporation of China Limited	-21.2	-3.45	-2.2	7.6	1.2	
Anshan Iron and Steel Group Corporation	-5.0	-0.82	-5.1	9.3	1.5	
Sinosteel Corporation	-3.8	-0.61	-3.8	1.9	0.3	
China Railway Materials Commercial Corp.	-2.7	-0.44	-2.8	1.3	0.2	
China Minmetals Corporation	-2.0	-0.32	-2.0	6.9	1.1	
China National Salt Industry Corporation	-0.2	-0.04	-0.3	1.8	0.3	
Harbin Electric Corporation	-0.2	-0.03	-0.2	1.3	0.2	
China National Gold Group Corporation	-0.2	-0.03	-0.2	2.7	0.4	
China First Heavy Industries	-0.2	-0.02	-0.2	0.5	0.1	

Source Author's calculation based on SASAC General Affairs Bureau (2016)

Although there were only 114 SOEs directly administered by central SASAC in 2014, there are 40,615 central SOEs after including their subsidiaries (SASAC, 2015, p. 699) – an average of 356 members in each SOE group. Since these may be in different industries it can be difficult to distinguish from the name of the group the extent of the operations of its subsidiaries. Businesses can be diversified well beyond the main sector of their parent company name (Eaton,

2013; Lardy, 2014, pp. 50–51). These include subsidiaries and joint ventures that may or may not be listed on the stock market, or otherwise involve mixed ownership.

3.3.1.2 Other central ministries and agencies

The central government also indirectly owns much of the financial sector outside the SASAC system. The head of the China Investment Corporation, a sovereign wealth fund established in 2007, is a direct appointment by the State Council, and its governance is heavily influenced by the Ministry of Finance (Hu, 2014). The China Investment Corporation is the parent of Central Huijin Investment Limited, which holds controlling shares in China's largest banks.[21] The Ministry of Finance also administers the China National Tobacco Corporation, China Post and the China Railway Corporation, which itself was converted from a ministry to corporate form in 2013 (China Railway Corporation, 2015).

Of this rump group of central SOEs, 372 are university-run enterprises. These enterprises fall under the jurisdiction of individual universities under the Ministry of Education. They were typically created to take advantage of some technology or other asset of the university, and include many high technology firms, including personal computer manufacturers Tongfang and Founder. Legend Holdings, the parent company of computer manufacturer Lenovo, is an academy-run enterprise founded by the Chinese Academy of Sciences (Eun, Lee and Wu, 2006). In the absence of a strong intellectual property regime, these enterprises are one way to provide incentives for the development and commercialisation of research conducted at the university (Fu and Zhang, 2017).

The Ministry of Finance is also responsible for overseeing more than one hundred 'central cultural enterprises' (mostly publishers). The China Film Group Corporation is an SOE under the State Administration of Press, Publication, Radio, Film and Television. Other examples include the Capital Airport Group Corporation, which owns the Beijing Capital Information Airport, and is itself administered by the Civil Aviation Administration of China. Less economically significant, but still reflecting the diversity of central SOEs, the four-star Beijing Debao Hotel is an SOE under the General Office of the State Council.

3.3.2 Local state owners

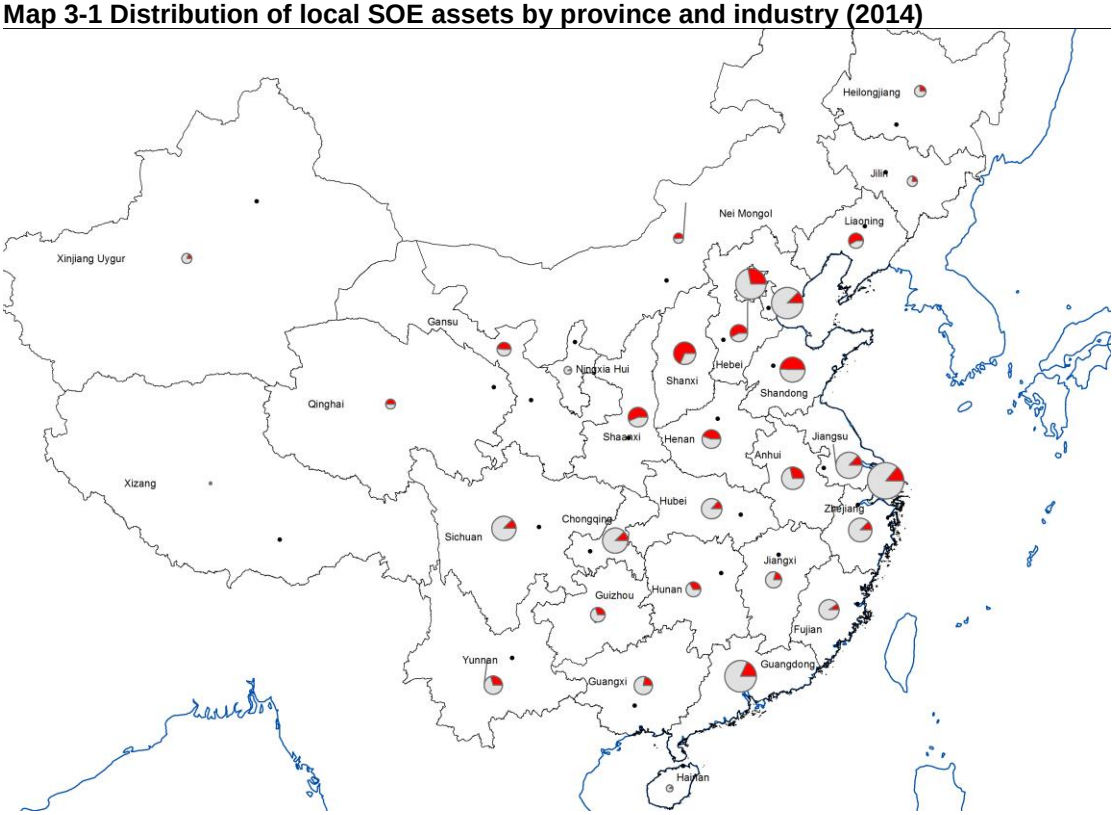
The administrative structures for managing provincial and local SOEs mirror those of central SOEs. Reporting to central SASAC, there is a provincial-level SASAC for each of China's 31 provincial level governments, as well as for the cities of Dalian, Ningbo, Xiamen,

[21] Banking executives tend to be technocrats originally drawn from the State's economic and planning ministries (Zhang, 2016).

Qingdao and Shenzhen.[22] In turn, these provincial-level SASACs oversee state asset administration offices and bureaux at the municipal, district and county levels.

The greatest value of local SOE assets is in the more developed coastal regions. Map 3-1 shows the distribution of SOE assets between provincial SASACs. The size of the pie represents the relative value of SOE assets in each province, which are concentrated in coastal provinces, and the area around Beijing. The colours represent the division between industrial SOEs (dark red) and those in non-industrial sectors (light grey). The weight of SOE assets in most provinces is toward non-industrial sectors – notably the social service, government and real estate sectors.

Map 3-1 Distribution of local SOE assets by province and industry (2014)

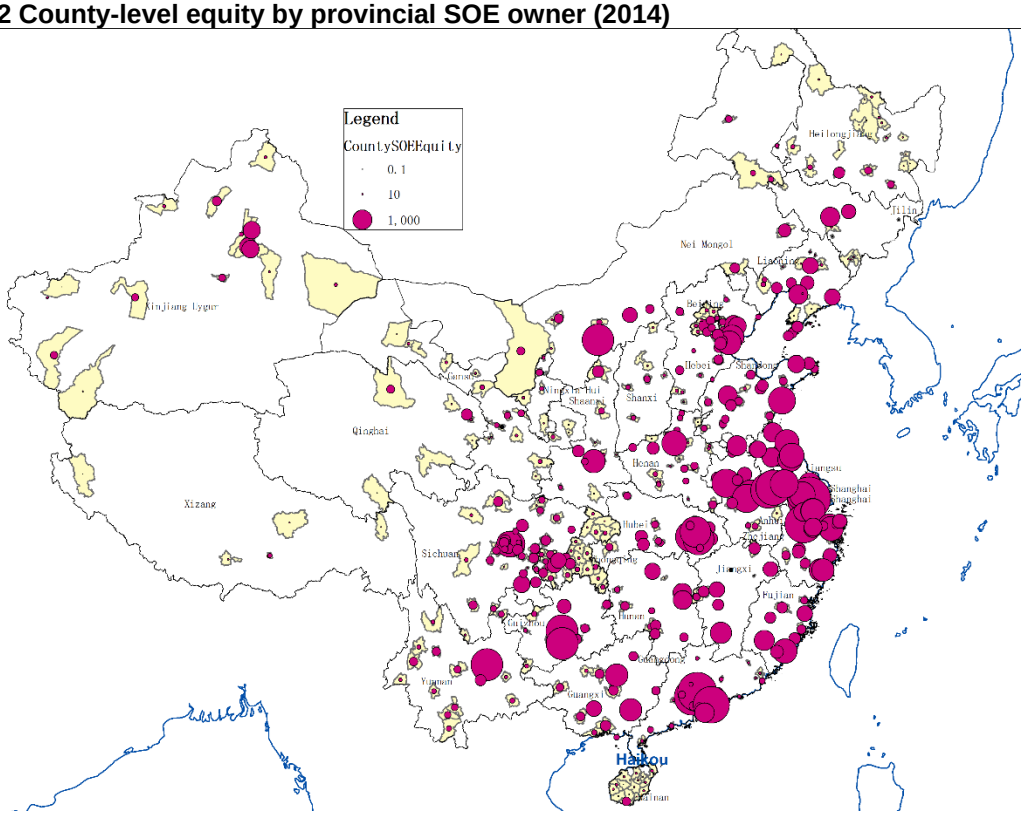


Source Author's map based on SASAC (2015, pp. 704–709)

[22] The Xinjiang Production and Construction Corps (or *bingtuan*) also has its own SASAC, separate from that of Xinjiang provincial SASAC. The bingtuan was established in 1954 and compromised of demobilised army units. In 1975 there were 12 plants – including two iron and steel plants (McMillen, 1981, p. 72). By 2014 the bingtuan were 1,068 SOEs and subsidiaries (including state farms, and social service enterprises), administered either directly by the bingtuan, its SASAC, or one of its 14 prefecture-level divisions (SASAC, 2015, p. 369).

A large proportion of these local SOE assets are administered at a sub-provincial level. Map 3-2 shows the distribution of SOE equity at the sub-provincial level. These are spread throughout 506 municipal, county and district level state asset offices and bureaux, as well as 11 special zones (such as free-trade zones or development zones). County-level SOE equity tends to be concentrated in coastal provinces, including along the Yangtze River, and inland around Chengdu. There is no systematic public reporting of SOEs by sector at this level.

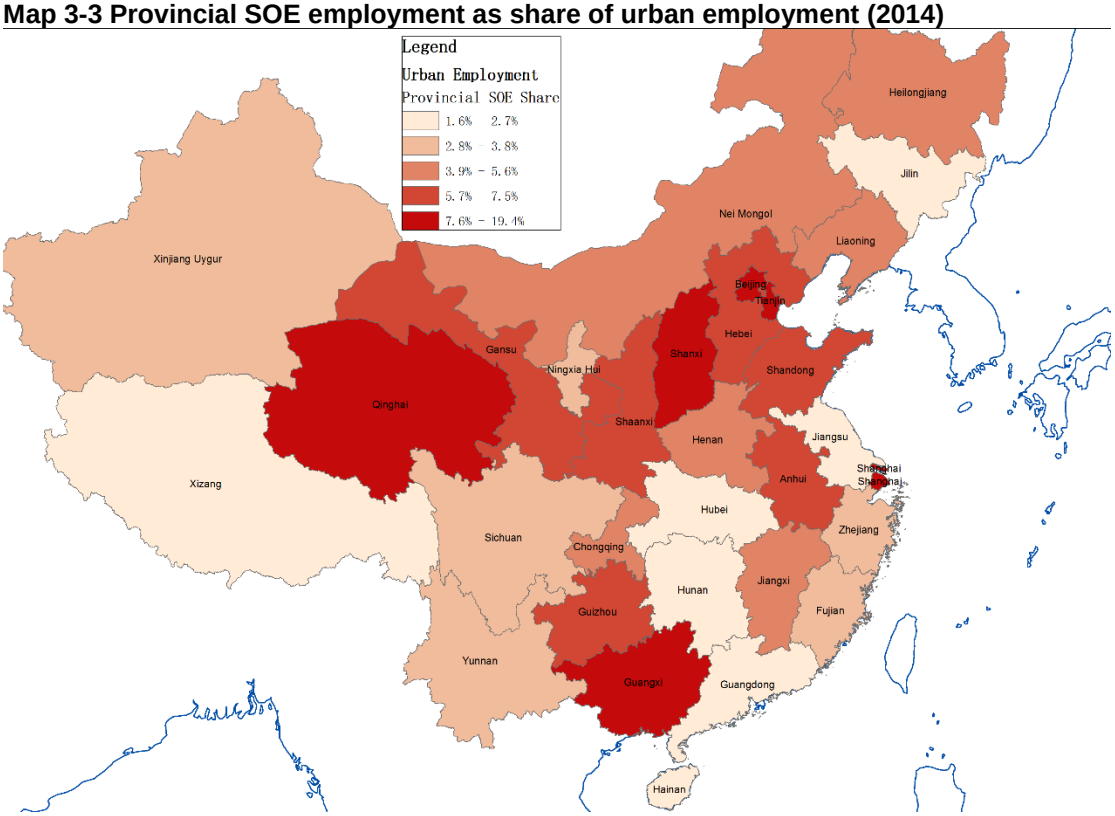
Map 3-2 County-level equity by provincial SOE owner (2014)



Source Author's map based on SASAC--

Provincial SOEs employed 16.4 million workers in 2014. Map 3-3 shows the share of provincial SOE employment in the total employment of each province. In the coastal provinces, the share of SOE employees is low – the concentration is much higher in the northern provinces around Beijing, and poorer inland provinces.

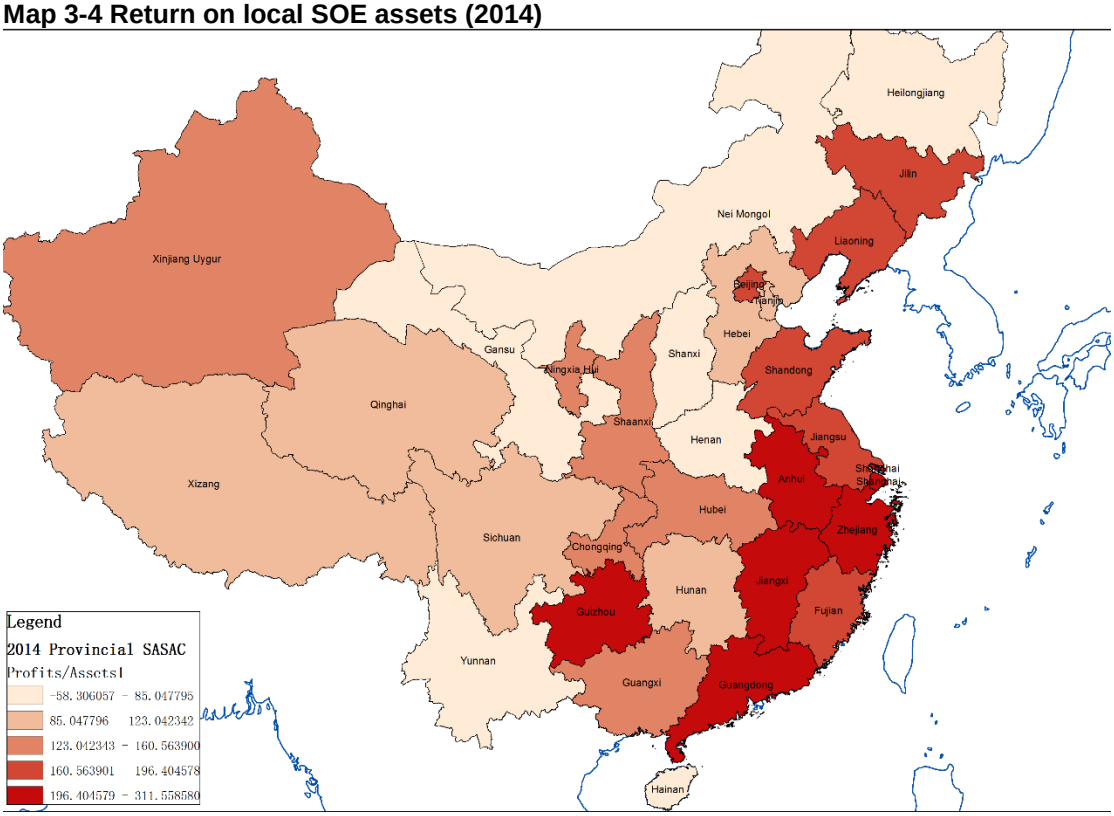
Map 3-3 Provincial SOE employment as share of urban employment (2014)



Source Author's map based on SASAC (2015, pp. 701–702) and Ministry of Human Resources and Social Security, Urban Employment, accessed through CEIC China Premium Database.

Map 3-4 shows that the highest return on SOE capital comes from coastal provinces and Beijing. Notably, the municipalities of Tianjin and Chongqing had high SOE investment, but low returns on SOEs. In Heilongjiang, provincial SOEs lost an average of 11,145 RMB per worker.

Map 3-4 Return on local SOE assets (2014)



Source Author's calculation based on SASAC (2015, p. 701,713-766).

Large local SOE conglomerates are uncommon. While there is no consistent and comprehensive statistical reporting on direct and indirect ownership of various types of SOEs, the 2010 SASAC Yearbook provided a breakdown of industrial sector SOEs according to whether they were directly administered by the state (first tier) or not (second and third tier). Fourth-tier subsidiaries and below are not reported. Table 3-11 shows that the industrial central SASAC SOEs that are part of corporate groups involve, on average, around two hundred subsidiaries.

Table 3-11 Industrial SOEs and their subsidiaries (2009)

	First tier	To third Tier	Employees	End of year state assets (billion RMB)
Industrial SOEs	10,125	36,618	18,445,000	7,340.98
of which, central	*590*	*11,222*	*8,464,000*	5,057.12
SASAC	56	10,442	7,734,000	4,258.13
Other	534	780	730,000	798.99
of which, local	*9,535*	*25,396*	*9,981,000*	2,283.86

Source SASAC (2010, p. 775)

Table 3-12 shows a detailed breakdown for Liaoning Province adapted from the province's report from the 2015 SASAC Yearbook. In total, there are 3,591 state-controlled companies of which just over half (1,812) are directly controlled a state agency. The remainder are indirectly controlled subsidiaries.

Table 3-12 Liaoning Province, direct and indirect local SOEs (2014)

	Total	Direct	Indirect
Whole Province	3,591	1,812	1,779
Provincial	*1,263*	*396*	*867*
SASAC	697	24	673
Other	566	372	194
Municipal	*2,328*	*1,416*	*912*
Dalian City	687	182	505
Shenyang City	497	235	262
Yingkou City	202	90	112
Dandong City	151	151	0
Fuxin City	148	148	0
Anshan City	115	115	0
Fushun City	110	104	6
Chaoyang City	105	78	27
Huludao City	72	72	0
Panjin City	70	70	0
Jinzhou City	68	68	0
Tieling City	51	51	0
Benxi City	26	26	0
Liaoyang City	26	26	0

Source Adapted from SASAC (2015, p. 128)

Even within these limited statistics it is possible to observe quite different holding patterns. SOEs that are controlled directly by smaller municipalities within the province tend to have no subsidiaries at all. The average number of subsidiaries per SOE is higher in large cities such as Dalian and Shenyang. For companies that are under direct administration at the provincial level, there is a clear distinction between SOEs controlled by Liaoning SASAC, and those controlled by other agencies of the provincial government.

At this provincial level, 87 per cent of state equity is controlled through the SASAC system. The largest Liaoning Provincial SASAC SOE is the Benxi Steel Group Corporation, which was the world's 21st largest steel maker by tonnage in 2015, and the 11th largest Chinese steel maker (World Steel Association, 2015). This steel company itself was the product of a 2010 merger between Benxi Steel and municipal level Beitai Steel (Benxi Steel Group Corporaton, 2017). It is also the parent of Bengang Steel Plates, a company listed on the Shenzhen stock exchange which in 2014 was listed 136th by revenue. The names of the other largest provincial SASAC SOEs also indicate that they are part of corporate groups rather than stand-alone enterprises. In total, the 24 Liaoning SASAC SOEs control 673 subsidiaries.

By contrast, the remaining 13 per cent of state equity administered at the provincial level is not administered through the SASAC system. Instead, local agencies such as the local water department, transport authority, and news and broadcasting authority directly control 372 SOEs, which between them have only 194 subsidiary companies.

3.4 Conclusion

The extent of state ownership in the Chinese economy varies greatly between sectors. SOEs have all but retreated from China's largest export-oriented manufacturing sector; but the state retains its traditional dominance in finance, construction, mining and utilities. It is in these latter sectors that China's (and some of the world's) largest SOEs are to be found. But such companies are becoming less representative of state ownership overall. With the continued development of China's economy, the services sector – particularly related to social services – is a large and growing share of state investment. Projections based on the state's share of fixed asset investment across different sectors suggest that overall the state's share of the economy may be approaching that of other mixed economies.

While China's most prominent SOEs tend to be sprawling conglomerates under the jurisdiction of central SASAC, these central SOEs are not typical of state ownership overall. Most state capital is now controlled by local state owners, at the provincial and county level. These SOEs are much more likely to be smaller, stand-alone enterprises. Their profitability, as well as their contribution to the local economy, varies regionally – with local SOE profitability being highest in the more developed coastal provinces where SOE employment is least significant. Local SOE assets are mostly outside the industrial sector. This diversity, not just amongst SOEs but between different state owners across China, cautions against SOEs as a homogenous category. The next chapter considers variation between sectors.

Chapter 4: The extent of state monopoly in Chinese industry[23]

Under the planned economy, Chinese industry was deliberately monopolised by the state. After decades of domestic and foreign competition, to what extent does this remain the case? Chapter 2 argued that SOE profitability could be a good indicator of performance in those competitive sectors where profits are not confounded by monopoly rents. An empirical assessment of which Chinese industrial subsectors are in fact competitive is necessary to identify those subsectors where a direct, profit-based comparison of SOEs and non-SOEs is most meaningful.

Previous studies, using the NBS' Survey of Above-Scale Industrial enterprises, have found a low degree of market concentration as measured in Chinese industry. Because the survey's unit of observation is the individual plant or legal entity, this misses potential coordination of economic activity between members of the large SOE conglomerates identified in the previous chapter. This chapter proposes some adjustments to account for this and identifies large state monopolies.

The 2011 Report to Congress of the US-China Economic and Security Review Commission claimed that 'in many sectors state-owned enterprises have substantial market power, allowing them to dictate prices and earn above-normal returns' (2011, p. 42). But after comparing the profit margins of state and non-state sectors from China's National Statistics Yearbook, Lardy argues that there is 'no evidence either that state firms as a group have long had market power that boosts their profitability' (2014, p. 26). Having identified concentrated sectors, this chapter considers which of these claims can be substantiated by the data? Is it possible to describe SOE behaviour in general – or is their proclivity to extract monopoly rents sector specific, as suggested by the framework presented in Chapter 2?

4.1 Measuring market concentration

To argue that industrial concentration is low in China, Lardy (2014, p. 23) relies on an OECD working paper (Conway *et al.*, 2010) and a related report (OECD, 2010). These studies found that, when measured by the Herfindahl-Hirschman Index (HHI) of market concentration (Hall and Tideman, 1967), only 34 of China's 523 industrial subsectors could be classified as 'highly concentrated' by 2008, compared to 88 of 591 industrial subsectors in 1998.

[23] This chapter is derived in part from Hubbard (2016), copyright Taylor & Francis, available online: http://dx.doi.org/10.1080/17538963.2016.1138695

The HHI is calculated by adding the sum of the squares of each firm's share of output in a particular sector. A subsector that is literally monopolised (that is, has a single seller) has a HHI of one. At the other extreme, in a subsector approaching perfect competition, all firms have an infinitesimally small share of revenue and so the industry's HHI approach zero. A duopoly in which two firms split revenue equally would have a HHI of 0.5. By contrast, if there were two firms in a subsector in which the leading firm had 75 per cent of revenue, and the second firm had only 25 per cent of revenue, HHI would increase to 0.625, reflecting the increased market concentration of the leading firm.

The 1997 revision of the anti-trust guidelines (U.S. Department of Justice and Federal Trade Commission, 1997)[24] defines an HHI less than 0.1 to be unconcentrated, between 0.1 and 0.18 to be moderately concentrated, and more than 0.18 to be highly concentrated.[25] While thresholds are somewhat arbitrary, they reflect an underlying logic that the difficulty of coordinating anti-competitive behaviour increases with the number of firms. Although cartels can be organised even in industries that are not highly concentrated, two-thirds of cartels in the United States had fewer than ten members (Levenstein and Suslow, 2006); a market divided equally amongst ten cartel members would have an HHI of 0.1, equivalent to the threshold for moderate concentration.

A major limitation of the OECD studies is that they provide a count of the *number* of subsectors that are concentrated, but do not account for their different economic weights. Between them, the largest 34 subsectors accounted for 50 per cent of Chinese industrial revenue in 2009, compared to just 0.1 per cent for the smallest 34 subsectors. This leaves an outstanding question of *which* subsectors are concentrated, and how significant they are to the economy overall. A second limitation of these studies is that the survey data on which the calculations rely do not recognise that the individual 'legal persons' that are the unit of analysis for the survey may be part of the large SOE conglomerates that are characteristic of central industrial SOEs. To address this, this chapter introduces novel adjustments to group survey observations based on both shared company names and shared administrative relationships (*lishu guanxi*) between SOEs in the same industrial subsector.

4.1.1 Enterprise-level survey data (2009)

The NBS annual industrial statistics are derived from an annual survey of 'above-scale industrial enterprises' (National Bureau of Statistics of China 2010b). This survey data is

[24] HHI has been used since 1982 to assess market concentration before and after potential corporate mergers for the enforcement of anti-trust laws in the United States (Calkins, 1983).
[25] These thresholds were revised in 2010, defining unconcentrated markets to be those with an HHI less than 0.15, moderately concentrated between 0.15 and 0.25, and highly concentrated above 0.25 (U.S. Department of Justice and Federal Trade Commission, 2010). Since these thresholds are arbitrary and to ensure consistency with the earlier thresholds used by Conway et al. (2010) and OECD (2010) this chapter applies the 1997 thresholds.

frequently used in empirical studies of China's industrial economy (Dougherty, Herd and He, 2007; Hsieh and Klenow, 2009; Brandt, Van Biesebroeck and Zhang, 2012; Liao and Tsui, 2012; Brandt, Tombe and Zhu, 2013; Li, Jian and Jiang, 2013; Du, Liu and Zhou, 2014). The structure of this data is well described by Brandt et al. (2014). The features relevant to the measurement of market concentration are described briefly in this section.

The survey's unit of analysis is the 'legal person', described in this chapter as a firm. Each firm is classified according to China's Industrial Classification for National Economic Activities. Prior to 2013, these included 521 industrial subsectors from the 2002 Industrial Classification for National Economic Activities (CSIC, GB/T 4754—2002).

An industrial enterprise is classified as 'above-scale' if the revenue from its main business is above a certain threshold, set at five million RMB (approximately US$1 million) between 2007 and 2010, and 20 million RMB (approximately US$3 million) since 2011. Because the HHI calculation includes very small firms, it is sensitive to the cut-off threshold – a rise in the threshold removes smaller competitors from the calculation and so places an upward bias on the measurement of HHI (Bai, Mao and Zhang, 2014). For this reason survey data from the 2009 year is used since it applies a lower threshold and covers 420,000 observations – the subsequent threshold increase excluded around 100,000 firms from the sample. Nevertheless, market concentration in Chinese industrial sectors is stable over time after adjusting for changes in threshold (Bai, Mao and Zhang, 2014), and so the findings in this chapter are likely to be applicable to subsequent years.

The previous chapter revealed significant differences between central SOEs and SOEs administered at a local level. These relationships can be observed in the survey data using the administrative relationship (*lishu guanxi*) variable, which reveals a firm's level of assignation within the state hierarchy (Tan, Li and Xia, 2007). The administrative relationship makes it possible to distinguish between SOEs controlled at the central level (SOE-Central), and those controlled at the provincial level and below (SOE-Local).

Table 4-1 provides summary statistics on the distribution of industrial revenue amongst ownership types. It shows that SOEs tend to be larger (both mean and median) than non-SOEs, with central SOEs being by far the largest. Central SOEs make up less than one percent of all industrial enterprises, but earn almost 13 per cent of industrial revenue.

Table 4-1 Revenue from main business, by controller (2009)

	Revenue (Million RMB)						
	Mean	Median	Max	Sum.	Share (%)	Obs.	Share (%)
SOE-Central	2,139.5	187.3	146,805.6	6,773,500.7	12.7	3,166	0.8
SOE-Local	486.7	56.0	209,937.1	8,201,693.2	15.4	16,850	4.0
State Sector				*14,975,194.0*	*28.1*	*20,016*	*4.7*
Collective	131.6	29.6	149,250.4	2,209,532.5	4.1	16,788	4.0
Private	74.1	25.3	111,049.6	22,358,580.4	42.0	301,694	71.5
Foreign	137.5	35.2	42,014.8	3,894,574.1	7.3	28,325	6.7
HMT	225.1	44.0	101,067.6	7,012,686.3	13.2	31,151	7.4
Other	116.2	29.4	33,553.9	2,807,102.4	5.3	24,149	5.7
Nonstate Sector				*38,282,475.8*	*71.9*	*402,107*	*95.3*
All	126.2	28.2	209,937.1	53,257,669.8	100.0	422,123	100.0

Table 4-2 shows that SOEs in the survey report a total of 21.3 trillion in total assets, compared to 21.7 trillion RMB reported in the China Financial Yearbook (China Ministry of Finance, 2015, p. 384), and 21.6 trillion RMB reported in the China Statistical Yearbook (National Bureau of Statistics of China, 2010, secs 14–6). According to the survey data, industrial assets are split roughly between central and local SOEs.

Table 4-2 Total industrial assets, by controller (2009)

	Assets (Million RMB)						
	Mean	Median	Max	Sum.	Share (%)	Obs.	Share (%)
SOE-Central	3,043	293	566,885	10,029,071	20.7	3,296	0.8
SOE-Local	658	80	222,665	11,260,611	23.3	17,102	4.1
State Sector				*21,289,682*	*44.0*	*20,398*	*4.8*
Collective	104	20	139,651	1,734,594	3.6	16,741	4.0
Private	48	14	93,086	14,507,160	30.0	301,467	71.4
Foreign	118	30	31,426	3,334,393	6.9	28,311	6.7
HMT	172	39	36,877	5,339,502	11.0	31,106	7.4
Other	89	18	36,306	2,138,362	4.4	24,100	5.7
Nonstate Sector				*27,054,011*	*56.0*	*401,725*	*95.2*
All	115	17	566,885	48,343,693	100.0	422,123	100.0

4.2 Statistical Results

Having calculated the HHI for each subsector, Table 4-3 lists the 20 subsectors out of 521 that are ‘highly concentrated’, based on a HHI threshold of 0.18. These subsectors are all very small in revenue terms – the largest, ‘switching equipment’ (a manufacturing sector creating components for electricity distribution), accounts for just 0.5 per cent of total industrial revenue.

Table 4-3 Highly concentrated subsectors

Four Digit Code	Industry Subsector	HHI	Revenue 1000 RMB	Share (%)	Cum. (%)
3759	Navigation Mark and Other Floating Equipment	0.607	4,179,077	0.01	0.0
3313	Nickel Cobalt Smelting	0.539	86,343,145	0.16	0.2
1093	Gem Stone Mining	0.445	600,402	0.00	0.2
2824	Polyvinyl Alcohol Fiber	0.384	3,262,602	0.01	0.2
4012	Switching Equipment	0.358	267,623,181	0.50	0.7
4690	Other Sewage Treatment, Utilizing and Distribution	0.356	6,480,314	0.01	0.7
3519	Other Motor Machine	0.336	9,261,692	0.02	0.7
1535	Solid Beverage	0.323	21,397,813	0.04	0.7
3679	Other Agriculture Machinery and Maintenance	0.310	40,208,489	0.08	0.8
922	Silver Ore Mining	0.280	3,247,388	0.01	0.8
3791	Diving and Underwater Succoring, Refloating Equipment	0.259	777,486	0.00	0.8
3491	Coin and Other Valued Metal Lab Products	0.257	3,523,434	0.01	0.8
4152	Slide Projector and Overhead Projector	0.248	2,173,051	0.00	0.8
1364	Fish Oil Distilling and Products	0.241	117,681	0.00	0.8
690	Other Coal Mining and Washing	0.213	2,374,134	0.00	0.8
4413	Nuclear Electric Power Generation	0.210	24,455,677	0.05	0.9
3314	Tin Smelting Industry	0.205	22,999,281	0.04	0.9
4151	Filming Machine	0.202	472,673	0.00	0.9
2823	Acrylic Fiber	0.199	7,689,740	0.01	1.0
3693	Postal Industrial Equipment	0.195	576,804	0.00	1.0

Table 4-4 lists the 31 'moderately concentrated' subsectors (HHI between 0.10 and 0.18). These are also a small proportion of Chinese industry. The largest moderately concentrated manufacturing subsector is air conditioners. Together, these 51 concentrated subsectors account for just 2.5 per cent of industrial revenue.

Table 4-4 Moderately concentrated subsectors

Four Digit Code	Industry Subsector	HHI	Revenue 1000 RMB	Share (%)	Cum. (%)
3952	Air Conditioner	0.177	231,634,868	0.43	1.4
52	Valued Metal Rolling Processing	0.157	63,847,478	0.12	1.5
3673	Forestry Mechanical Equipment	0.157	314,420	0.00	1.5
1091	Asbestos and Mica Ore Mining	0.156	1,716,690	0.00	1.5
3674	Husbandry Mechanical Equipment	0.155	2,604,319	0.00	1.5
3513	Steam Turbine and Fitting	0.153	46,590,473	0.09	1.6
3769	Other Aircraft	0.151	587,286	0.00	1.6
2413	Teaching Specimen and Mode	0.149	4,805,876	0.01	1.6
4124	Meter Apparatus for Farming, Forestry, and Fishing	0.146	604,873	0.00	1.6
933	Radioactive Metal Ore Mining	0.145	911,785	0.00	1.6
3514	Water Turbine and Fitting	0.142	4,446,066	0.01	1.6
4020	Radar Detectors and Auxiliary Apparatus	0.139	12,972,703	0.02	1.7
2623	Kalium Fertilizer	0.138	16,111,953	0.03	1.7
3799	All Other Transportation Equipment	0.138	16,180,315	0.03	1.7
2673	Oral Cavity Sanitary Products	0.138	9,895,591	0.02	1.7
3951	Household Refrigerator and Home Freezer	0.131	174,817,641	0.33	2.1
4159	Other Stationery and Office Machine	0.128	5,180,766	0.01	2.1
1100	Other Ore Mining	0.124	1,413,218	0.00	2.1
3752	Non-metal Ship Building	0.123	5,297,763	0.01	2.1
2671	Soap, Washing Powder and Synthetic Detergent	0.116	102,522,317	0.19	2.3
3671	Tractor	0.116	37,747,488	0.07	2.3
3162	Mica Product Industry	0.114	2,941,352	0.01	2.3
3762	Aircraft	0.113	6,904,448	0.01	2.4
1461	Monosodium Glutamate	0.112	38,958,037	0.07	2.4
3692	Geology Reconnaissance Special Equipment	0.110	2,674,712	0.01	2.4
2452	Entertaining Appliances and Indoor Amusement Eq.	0.108	5,864,438	0.01	2.5
2414	Ink	0.107	710,280	0.00	2.5
3471	Industrial Use Enamel Products	0.107	3,066,427	0.01	2.5
3683	Lab and Disinfectant Equipment and Utensils	0.106	4,042,345	0.01	2.5
932	Earth Metal Ores Mining	0.104	2,068,264	0.00	2.5
4125	Geologic Prospecting, Earthquakes use Instrument	0.102	5,909,152	0.01	2.5

Although this result has detected 20 'highly concentrated' and 31 'moderately concentrated' industrial subsectors, these tend to be insignificant in economic terms – cumulatively accounting for just 2.5 per cent of total revenue for China's industrial sector in 2009. By contrast, Table 4-5 lists revenue concentration in China's 20 largest industry subsectors, collectively accounting for 40 per cent of survey revenue. All of these are

comfortably below the threshold for market concentration, apparently supporting the proposition that China's industrial economy is highly competitive.

Table 4-5 Concentration of largest industrial subsectors

Four Digit Code	Industry Subsector	HHI	Revenue 1000 RMB	Share (%)	Cum. (%)
3230	Steel Rolling Processing	0.008	3,059,250,726	5.74	5.7
4420	Transmission and Distribution of Electric Power	0.030	2,131,028,640	4.00	9.7
2511	Crude Oil Processing and Petroleum Product	0.016	1,750,413,633	3.29	13.0
610	Bituminous Coal and Anthracite Mining and Washing	0.008	1,616,151,873	3.03	16.1
3721	Automobile Complete	0.028	1,529,386,077	2.87	18.9
3725	Automobile Parts and Attachments	0.003	1,189,499,367	2.23	21.2
4411	Thermal Power Generation	0.004	998,594,413	1.88	23.0
1711	Cotton and Chemical Fiber Spinning and Weaving Processing	0.007	975,890,781	1.83	24.9
1810	Apparel	0.001	937,567,445	1.76	26.6
4041	Computer Body	0.051	869,298,348	1.63	28.3
3351	Commonly Used Non-Ferrous Rolling Processing	0.004	855,195,408	1.61	29.9
3220	Steel Smelting	0.053	754,485,885	1.42	31.3
3931	Wire and Cable Manufacturing	0.003	661,769,078	1.24	32.5
710	Crude Oil and Gas Mining	0.096	622,852,095	1.17	33.7
4043	Computer Peripheral Equipment	0.023	603,042,057	1.13	34.8
4061	Electronic Components	0.012	595,740,070	1.12	36.0
3111	Cement	0.002	560,551,127	1.05	37.0
2614	Organic Chemical Material	0.016	548,556,270	1.03	38.0
1331	Edible Vegetable Oil Processing	0.007	481,903,142	0.90	38.9
1620	Cigarettes	0.041	472,392,978	0.89	39.8

4.2.1 Adjusting market concentration estimates to account for SOE groups

The very low HHI figures for some subsectors warrant further investigation. For example, China's oil giants Sinopec and China National Petroleum, and the national electricity grid State Grid, were all ranked in the top ten of Fortune 500 companies by revenue for 2009 (Xinhua, 2010). But of the subsectors, which these companies presumably dominate, only 'crude oil and gas mining' appears to be remotely concentrated (with an HHI just below the moderate concentration margin, at 0.096).

Similarly, the entire tobacco industry is unashamedly monopolised by the State Tobacco Monopoly Administration (Central People's Government of the People's Republic of China, 2012). But the twentieth largest subsector, the manufacture of cigarettes, has an HHI of 0.041, making it only the 148th most concentrated subsector according to this measure. The failure of the HHI, as calculated on an enterprise basis, to identify these subsectors as even moderately concentrated suggests that the raw HHI calculation is an adequate to identify monopolies.

Table 4-6 shows the distribution of central and local SOE assets across subsectors. Cumulatively, these 20 largest subsectors (by revenue) account for 42 per cent of industrial assets. SOEs control most assets in nine subsectors, including the five largest. In five of these nine state-dominated sectors – relating to oil, electricity and tobacco – central SOEs have a greater share of assets than local SOEs. State ownership is close to 100 per cent in 'transmission and distribution of electric power', 'crude oil and gas mining', and the manufacture of cigarettes.[26] There are also large subsectors, such as cotton weaving, apparel, computer bodies, wire manufacturing and computer and electrical components, in which the share of state ownership is negligible.

Table 4-6 State ownership in twenty largest subsectors (2009)

Four Digit Code	Industry Subsector	Assets 1000 RMB	SOE Share %	Cum. %	Central %	Local %	Total %
3230	Steel Rolling Processing	2,852,592,912	5.9	5.9	17	44	61
4420	Transmission and Distribution of Electric Power	2,962,797,127	6.1	12.0	79	20	99
2511	Crude Oil Processing and Petroleum Product	868,567,442	1.8	13.8	62	20	82
610	Bituminous Coal and Anthracite Mining and Washing	2,210,070,221	4.6	18.4	12	64	76
3721	Automobile Complete	1,228,060,564	2.5	20.9	29	55	84
3725	Automobile Parts and Attachments	953,508,892	2.0	22.9	4	12	16
4411	Thermal Power Generation	2,197,221,646	4.5	27.5	45	37	82
1711	Cotton and Chemical Fiber Spinning and Weaving Processing	676,121,018	1.4	28.9	1	7	8
1810	Apparel	553,349,213	1.1	30.0	1	2	3
4041	Computer Body	295,222,614	0.6	30.6	0	5	5
3351	Commonly Used Non-Ferrous Rolling Processing	483,509,840	1.0	31.6	7	9	16
3220	Steel Smelting	795,237,636	1.6	33.3	22	50	73
3931	Wire and Cable Manufacturing	404,606,614	0.8	34.1	1	5	5
710	Crude Oil and Gas Mining	1,240,637,394	2.6	36.7	89	8	97
4043	Computer Peripheral Equipment	302,259,577	0.6	37.3	2	4	5
4061	Electronic Components	438,830,479	0.9	38.2	1	11	12
3111	Cement	718,213,487	1.5	39.7	4	29	33
2614	Organic Chemical Material	505,333,998	1.0	40.7	26	23	49
1331	Edible Vegetable Oil Processing	253,716,105	0.5	41.2	2	9	10
1620	Cigarettes	473,789,048	1.0	42.2	91	8	100

[26] Although the state chose to monopolise the production and distribution of tobacco products, it did not do so through a single nation-wide conglomerate. Nor were the market reforms applied to other sectors from the 1980s extended to tobacco. Wang (2013) provides an excellent account of the industry, and illustrates how de facto competition and entrepreneurial behaviour is possible even in a formally state-owned and centrally planned industry.

The reason why these state monopolies are not detected by the 'raw' HHI calculation is that the unit of analysis of the survey is a 'legal person'. In 2007, 96.6 per cent of these 'legal persons' were single-plant firms (Brandt, Van Biesebroeck and Zhang, 2014, p. 340). But the previous chapter showed that industrial SOEs – particularly those under the jurisdiction of central SASAC – are often part of large corporate groups of hundreds of related entities. Failure to account for potentially related parties means that the standard measure fails to identify concentration in sectors such as oil and gas, electricity and tobacco.

4.2.1.1 Grouping based on name

Membership of SOE groups is not recorded in the survey. One approach to identifying them is by inference, noting that members of a group often share the first part of their name. For example, the names of 44 enterprises in the survey begin with the Chinese characters for 'Sinopec Group' (中国石化集团). By identifying a range of suffixes that typically end the names of companies (for example, equivalent to Ltd., Corp., Group), a parent name can be constructed based on the Chinese characters to the left of the first suffix. For example, 'Sinopec Group Nanjing Chemical Industry Ltd. Corp. (中国石化集团南京化学工业有限公司)' becomes associated with the parent name 'Sinopec (中国石化)'. All observations with the same parent name within the same subsector are then consolidated into a single observation for that parent. For example, this leaves 22 consolidated revenue observations for Sinopec across 22 subsectors. Overall, this consolidates into 9,803 observations.

When revenue from an enterprise identified as a central SOE is consolidated with another enterprise, the new consolidated revenue is attributed to a central SOE. Similarly, if a local SOE is consolidated with a non-SOE, then the consolidated figure is attributed to the local SOE. This assumes that non-SOEs may be subsidiaries of SOEs (say, if the SOE is not the majority shareholder), but that an SOE will not be a subsidiary of a non-SOE. Local subsidiaries of a central SOE may identify on the survey with their local jurisdiction, but in reality be controlled by a central SOE. This allocates an additional 1.7 per cent of survey revenue to the state sector.

After recalculating HHI based on consolidated revenue, Table 4-7 shows the five subsectors that were previously measured as unconcentrated, but that now appear to be concentrated. Three of these, accounting for 4.8 per cent of total industrial revenue, relate to oil and gas. The consolidated measure of concentration for cigarette manufacturing increases from 0.041 to 0.046, after reducing the number of observations in this subsector from 67 to 53.

Table 4-7 Concentrated industry subsectors after consolidating names

Four Digit Code	Industry Subsector	HHI Raw	HHI Adjusted	Difference	Share of Industrial Revenue %
710	Crude Oil and Gas Mining	0.096	0.149	0.054	1.2
2511	Crude Oil Processing and Petroleum Product	0.016	0.133	0.117	3.3
790	Support Activities for Oil and Gas Mining	0.069	0.125	0.057	0.3
916	Aluminum Ore Mining	0.095	0.112	0.017	0.0
4127	Nucleon and Nuclear Radiation Measuring Apparatus	0.090	0.106	0.017	0.0

While grouping by name is an improvement, it is still inadequate to identify all group members. Table 4-8 shows the maximum revenue for a central SOE in a single subsector is 505 billion RMB (approx. US$74 billion) compared to 147 billion RMB (approx. US$21 billion) reported in Table 4-1. This can be compared to the scale of Sinopec Group, for which 2009 revenues across all sectors was US$187 billion (Xinhua, 2010). While some of Sinopec's group revenue may fall outside its oil subsector, much of its revenue appears still not to be captured.

Table 4-8 Revenue by ownership type, observations grouped by name

	Revenue (1000 RMB)					Observations	
	Mean	Median	Max	Sum.	Share %	N	Share %
SOE-Central	2,399,937	177,398	505,336,166	6,993,416,182	13	2,914	1
SOE-Local	504,127	56,501	211,653,269	8,241,975,323	15	16,349	4
State Sector				*15,235,391,505*	*29*	*19,263*	*5*
Collective	131,830	29,673	149,250,409	2,158,720,178	4	16,375	4
Private	75,694	25,767	130,067,501	22,357,554,098	42	295,369	72
Foreign	138,198	35,568	56,854,349	3,816,619,346	7	27,617	7
HMT	229,224	43,982	101,067,603	6,910,190,933	13	30,146	7
Other	117,847	29,845	33,553,930	2,779,193,691	5	23,583	6
Nonstate Sector				*38,022,278,246*	*71*	*393,090*	*95*
All	129,156	28,629	505,336,166	53,257,669,751	100	412,353	100

For many related groups, identification based on name is insufficient. For example, because the name of many SOEs are according to a location, this method does not consolidate revenues from all tobacco subsidiaries (for example, 'Guangdong Central Tobacco' and 'Guangxi Central Tobacco' remain as separate observations).

Basing groupings on names also misses business groups that have been formed by mergers and acquisitions of differently named companies. For example, the creation of the Benxi Steel Group Corporation to be a holding company for the state-owned Benxi and Beitai steel companies in Liaoning need not affect the reporting to statistical authorities, given that both plants might continue to operate as separate legal subsidiaries (see Section 3.3.2). So long as each plant's output volume and price remains unchanged, so too does total revenue and so HHI is unaffected. The newly created corporate group may be able to coordinate production between the two previously competing entities in such a way that output is restricted in either (or both)

plants. What is, in fact, an increase in market concentration is not identified in the HHI. Other forms of horizontal ties falling short of a complete merger – such as joint ventures or strategic alliances – might similarly reduce competition in an industry without registering an increase in HHI (Bresnahan and Salop, 1986).

4.2.1.2 Grouping based on common administrative relationship

To account for the deficiencies of grouping by name, a further operational assumption is employed such that each SOE is deemed to be ultimately controlled by central owner or a local owner. This is based on the administrative relationship, with local owners grouped at the provincial level. That owner is assumed to be able to coordinate activity all SOEs in the same subsector operating within its jurisdiction. This still allows for competition between SOEs across provincial boundaries (as local owners do not cooperate with each other) and vertically (central owners do not cooperate with provincial owners).

For example, the revenues from any SOEs belonging to either Sinopec or PetroChina would be assigned to a 'central oil' category. SOEs with administrative relationships at the provincial level or below are assigned to one of 31 hypothetical provincial owners. For example, all local SOE coal mines in Hebei would be assigned to a 'Hebei Coal SASAC' observation, while local SOE coal mines in Shaanxi would be assigned to a 'Shaanxi Coal SASAC' observation.

This approach reduces the number of observations by 14,168 to 5,095. Table 4-9 shows that central SOEs are active across 350 subsectors, the largest of which had revenues of 1,486 billion RMB (US$217 billion). This captures 61 per cent of the combined revenues for China's two largest oil companies – Sinopec and CNPC – which in 2009 was $353 billion (Xinhua, 2010).

Table 4-9 Revenue consolidated by common administrative relationship

	Revenue (1000 RMB)				Observations	
	Mean	Max	Sum.	Share %	N	Share %
SOE-Central	19,981,189	1,486,694,640	6,993,416,182	13	350	0
SOE-Local	1,736,981	230,789,089	8,241,975,323	15	4,745	*1*
State Sector			*15,235,391,505*	*29*	*5,095*	*1*
Collective	131,830	149,250,409	2,158,720,178	4	16,375	4
Private	75,694	130,067,501	22,357,554,098	42	295,369	74
Foreign	138,198	56,854,349	3,816,619,346	7	27,617	7
HMT	229,224	101,067,603	6,910,190,933	13	30,146	8
Other	117,847	33,553,930	2,779,193,691	5	23,583	6
Nonstate Sector			*38,022,278,246*	*71*	*393,090*	*99*
All	133,751	1,486,694,640	53,257,669,751		398,185	

Table 4-10 shows the 'potential' HHI for each subsector – that is, the degree of concentration that could be achieved if the above assumptions were satisfied in practice. In total,

22 previously unconcentrated subsectors are recognised as potentially concentrated. Fourteen subsectors, including oil and gas, tobacco, and electricity, are identified as potentially highly concentrated (HHI over 0.18). A further eight subsectors that are potentially moderately concentrated (HHI between 0.1 and 0.18), including the manufacture of complete automobiles. These potentially concentrated subsectors account for 15.7 per cent of total industrial revenue, compared to the 2.5 per cent revenue for subsectors that are concentrated on 'raw' HHI measures.

Table 4-10 Concentrated subsectors after consolidating SOE owners

Four Digit Code	Industry Subsector	HHI Raw	HHI Potential	Revenue 1000 RMB	Share %	Cum. %
1620	Cigarettes	0.041	0.842	472,392,978	0.89	0.9
710	Crude Oil and Gas Mining	0.096	0.829	622,852,095	1.17	2.1
3761	Airplane and Repairing	0.036	0.667	110,949,821	0.21	2.3
3719	Other Rail Transportation Equipment and Repairing	0.048	0.649	15,220,979	0.03	2.3
790	Support Activities for Oil and Gas Mining	0.069	0.604	163,297,772	0.31	2.6
2511	Crude Oil Processing and Petroleum Product	0.016	0.520	1,750,413,633	3.29	5.9
4420	Transmission and Distribution of Electric Power	0.030	0.501	2,131,028,640	4.00	9.9
3711	Locomotives and Trains,	0.065	0.477	82,815,316	0.16	10.0
3669	Aviation, Aerospace and Other Special Equipment	0.077	0.381	7,127,602	0.01	10.1
1610	Tobacco Leaf Processing	0.092	0.323	9,415,980	0.02	10.1
4412	Hydroelectric Power Generation	0.026	0.223	140,757,499	0.26	10.3
4411	Thermal Power Generation	0.004	0.222	998,594,413	1.88	12.2
916	Aluminum Ore Mining	0.095	0.219	8,953,661	0.02	12.2
3714	Rail Apparatus, Equipment and Parts	0.026	0.204	35,216,258	0.07	12.3
3755	Ship Repairing and Dismantling	0.074	0.173	56,019,595	0.11	12.4
3615	Special Metallurgy Equipment	0.059	0.161	91,656,179	0.17	12.6
3721	Automobile Complete	0.028	0.131	1,529,386,077	2.87	15.4
4127	Nucleon and Nuclear Radiation Measuring Apparatus	0.090	0.124	712,754	0.00	15.4
2622	Phosphate Fertilizer	0.069	0.123	44,904,279	0.08	15.5
4419	Other Power Industry	0.016	0.114	29,410,401	0.06	15.6
915	Antimony Ore Mining	0.074	0.108	1,203,970	0.00	15.6
3321	Gold Smelting	0.085	0.107	77,368,040	0.15	15.7

The method of calculating potential industry concentration by consolidating SOEs according to hypothetical SASAC owners indirectly links potential HHI to state dominance on the production side. For example, the nuclear electric power generation subsector contains six enterprises, five of which are central SOEs. The raw HHI of the industry is 0.210, but potential HHI is 0.997 based on their ultimate owner. For this reason, concentrated subsectors presented

in the previous table will be those in which there is a significant share of state ownership. Indeed, once central SOEs have a revenue share of 31 per cent, the potential HHI is concentrated (since the square of 31 per cent rounds up to 0.1) and highly concentrated once the central SOE revenue share exceeds 42 per cent (since the square of 42 per cent rounds up to 0.18).

Table 4-11 shows that while the share of revenue between state-owned and non-state-owned subsectors remains the same (31 per cent), those subsectors which are majority state owned are much more likely to be concentrated.

Table 4-11 Subsectors and revenue by potential industry concentration and state ownership share

		SOE Asset Share				Total	
		< 50%		> 50%			
		Subsectors	Revenue %	Subsectors	Revenue %	Subsectors	Revenue %
Potential HHI	> .10	34	2	39	16	73	18
	< .10	421	67	27	15	448	82
Total		455	69	66	31		

Table 4-12 decomposes the 66 majority SOE-owned subsectors into those that are dominated by central owners, and the rest. Of the 31 sectors in which central state ownership is dominant, 25 are potentially concentrated according to the HHI measure. Together these subsectors account for 13 per cent of total industrial revenue. The five largest subsectors, accounting for 11.2 per cent of total industrial revenue, are transmission and distribution of electric power (4.0 per cent, Potential HHI 0.5), crude oil processing and petroleum products (3.3 per cent, Potential HHI 0.52), thermal power generation (1.9 per cent, Potential HHI 0.22), crude oil and gas mining (1.2 per cent, Potential 0.83), and cigarettes (0.9 per cent, Potential HHI 0.84).

Table 4-12 Majority state-owned subsectors

		Majority SOE Assets				Total	
		Majority Central		Majority Local			
		Subsectors	Revenue %	Subsectors	Revenue %	Subsectors	Revenue %
Potential HHI	> .10	25	13	14	3	39	16
	< .10	6	1	21	14	27	15
Total		31	14	35	17	66	31

By contrast, subsectors in which local SOEs are dominant tend to be unconcentrated (and account for 14 per cent of total industrial revenue). The three largest of these, accounting for 10.2 per cent of total industrial revenue are steel roll processing (5.7%, Potential HHI 0.21), coal mining (3% Potential HHI 0.05) and steel smelting (1.4% Potential HHI 0.07).

Table 4-13 shows that while manufacturing assets overall – including local SOE assets – are found in unconcentrated subsectors, it is SOEs – and particularly central SOEs – that dominate concentrated subsectors.

Table 4-13 Assets by ownership and concentration

	Total Industry Assets (Million RMB)		Share of Total %		Share of assets in unconcentrated and concentrated subsectors		Share by Owner %	
Potential HHI	U	C	U	C	U	C	U	C
SOE-Central	2,526,858,705	7,502,212,170	5	16	7	60	25	75
SOE-Local	7,950,233,690	3,310,377,239	16	7	22	26	71	29
State	*10,477,092,395*	*10,812,589,409*	*22*	*22*	*29*	*86*	*49*	*51*
Collective	1,416,409,352	318,185,070	3	1	4	3	82	18
Private	13,796,638,477	710,521,744	29	1	39	6	95	5
Foreign	3,099,417,188	234,975,503	6	0	9	2	93	7
HMT	5,032,277,955	307,224,373	10	1	14	2	94	6
Other	1,939,879,820	198,481,930	4	0	5	2	91	9
Nonstate	*25,284,622,792*	*1,769,388,620*	*52*	*4*	*71*	*14*	*93*	*7*
All	35,761,715,187	12,581,978,029	74	26	100	100		

Note (U) Unconcentrated, HHI < 0.1, (C) Concentrated, HHI > 0.1

The distribution of non-state firms in the most competitive subsectors reflects the dynamics described in the first chapter – since new entrants tend not to be state-owned, over time a much higher proportion of non-state companies will operate where barriers to entry are lowest. Even if there is no explicit policy to keep concentrated sectors in state ownership, the fact that these sectors of the economy were state owned to begin with means that they are much more likely to remain state owned given higher barriers to entry.

These results show that previous estimates of HHI based on raw NBS plant-level data tend to dramatically underestimate market concentration by failing to account for potential coordination between members of SOE conglomerates. After making adjustments to account for this, the findings qualify, rather than overturn, the claim that Chinese industry is largely competitive. Results so far can be summarised into four stylised facts about state ownership and market concentration:

1. Most Chinese industrial assets are in unconcentrated sectors.
2. Unconcentrated sectors[27] of the Chinese economy are predominantly non-state owned.
3. Provincial and local SOEs tend to hold assets in unconcentrated sectors; and,
4. Concentrated sectors of the Chinese economy are predominantly owned by central SOEs.

[27] After making the adjustments to account for SOE groups.

4.2.2 Identification of large state-monopoly sectors

Table 4-14 lists concentrated subsectors in order of their contribution to total industrial revenue (See Appendix A:Potential concentration of all industrial subsectors (2009) for complete listing of concentration and state ownership for all industrial subsectors).

Table 4-14 Concentrated subsectors by revenue and ownership

Four Digit Code	Industry Subsector	HHI		Revenue		State Ownership			Dominant SOE Ownership
		Raw	Potential	Share %	Cum. %	Central %	Local %	Total %	
4420	Transmission and Distribution of Electric Power	0.03	0.50	4.00	4.0	80	20	99	Central
2511	Crude Oil Processing and Petroleum Product	0.02	0.52	3.29	7.3	62	20	82	Central
3721	Automobile Complete	0.03	0.13	2.87	6.2	33	55	88	Local
4411	Thermal Power Generation	0.00	0.22	1.88	4.7	46	37	83	Central
710	Crude Oil and Gas Mining	0.10	0.83	1.17	3.0	89	8	97	Central
1620	Cigarettes	0.04	0.84	0.89	2.1	92	8	100	Central
4012	Switching Equipment	0.36	0.40	0.50	1.4	40	2	42	Nonstate
3952	Air Conditioner	0.18	0.20	0.43	0.9	0	36	36	Nonstate
3951	Household Refrigerator and Home Freezer	0.13	0.13	0.33	0.8	0	12	12	Nonstate
790	Support Activities for Oil and Gas Mining	0.07	0.60	0.31	0.6	82	11	94	Central
4412	Hydroelectric Power Generation	0.03	0.22	0.26	0.6	52	31	84	Central
3761	Airplane and Repairing	0.04	0.67	0.21	0.5	91	2	93	Central
2671	Soap, Washing Powder and Synthetic Detergent	0.12	0.12	0.19	0.4	0	8	8	Nonstate
3615	Special Metallurgy Equipment	0.06	0.16	0.17	0.4	39	38	77	Central
3313	Nickel Cobalt Smelting	0.54	0.54	0.16	0.3	0	78	78	Local
3711	Locomotives and Trains	0.06	0.48	0.16	0.3	70	17	87	Central
3321	Gold Smelting	0.08	0.11	0.15	0.3	5	65	70	Local
3352	Valued Metal Rolling Processing	0.16	0.18	0.12	0.3	1	15	16	Nonstate
3755	Ship Repairing and Dismantling	0.07	0.17	0.11	0.2	53	18	72	Central
3513	Steam Turbine and Fitting	0.15	0.29	0.09	0.2	63	25	88	Central
2622	Phosphate Fertilizer	0.07	0.12	0.08	0.2	0	68	68	Local
3679	Other Agriculture Machinery and Maintenance	0.31	0.31	0.08	0.2	8	40	48	Nonstate
1461	Monosodium Glutamate	0.11	0.11	0.07	0.1	0	28	28	Nonstate
3671	Tractor	0.12	0.12	0.07	0.1	40	13	53	Central
3714	Rail Apparatus, Equipment and Parts	0.03	0.20	0.07	0.1	53	5	58	Central

Grouping related sectors, this suggests three large central SOE monopolies – electricity, oil tobacco.

Electricity: Includes generation and distribution (subsectors 4420, 4411, 4012, 4412, 4419 and 4413, nuclear power generation). This accounts for 37 per cent of revenue in concentrated subsectors.

Oil: Includes both extraction and refining (subsectors 2511, 710, 790). This accounts for 26 per cent of revenue in concentrated subsectors.

Tobacco: Includes cigarette manufacturing and tobacco leaf processing (subsectors 1620 and 1610); accounts for five per cent of revenue in concentrated subsectors.

4.2.2.1 Potential market concentration in automobiles[28]

The automobile subsector (3721), which accounts for 16 per cent of revenue in concentrated sectors, is also identified as potentially concentrated amongst local SOEs on this measure. But a closer examination of this sector suggests that one of the assumptions on which the 'potential HHI' was constructed – that the provincial owner is able effectively to coordinate behaviour of all SOEs under its administrative jurisdiction – may not hold (Chu, 2011).

In the planned economy period, China's First Auto Works and Second Auto Works were set up in northeast China and central China respectively, to concentrate on truck building as part of the plan to build up heavy industry. Passenger cars were a bourgeois luxury – annual Chinese passenger car production did not exceed 1,000 until 1973. In the absence of a modern domestic automotive industry the development of this sector during the 1980s relied on technological transfer through joint ventures (Chu, 2011).

Beginning in 1983 with a joint venture that created the Beijing Jeep Company, China's existing automotive companies entered joint venture arrangements with leading foreign brands including Peugeot, Daihatsu, Volkswagen and Citroën. The industry was sheltered behind high tariff walls and high domestic content requirements. By 2002, when China had joined the WTO, both domestic content restrictions and foreign entry barriers had been lowered. Domestic car production had grown to over one million units per year and indigenous car makers including SOEs Hafei and Chery, and non-SOEs Geely and BYD, began to occupy a strong market position (Chu, 2011). However, by 2008 GM and VW branded automobiles remained the market leaders, each accounting for just over ten per cent of motor vehicle sales (Tang, 2009). Policy efforts to consolidate and create national champion automobile manufacturers appear to have failed (Lardy, 2014, p. 144).

[28] Thanks to Richard Herd for his comments on Hubbard (2016) which led to further consideration of market power in the Chinese automobile industry

Table 4-15 shows that on the basis of brand in 2008, the HHI for the car industry would be around 0.04, and therefore should not be considered as concentrated. This will be further tested in the next section, which considers relative profitability in concentrated and unconcentrated subsectors.

Table 4-15 Market share of motor vehicle sales by brand (2008)

Brand	Share of Motor Vehicle Sales (%)	Squared
General Motors	11.30	0.0128
Volkswagen	10.10	0.0102
Toyota	5.60	0.0031
Honda	4.90	0.0024
Hyundai-Kia	4.60	0.0021
Chery	3.70	0.0014
Nissan	3.60	0.0013
FAW	3.20	0.0010
Geely	2.50	0.0006
Mazda	2.20	0.0005
Sum	51.70	0.0354

Source based on Tang (2009)

4.3 Potential industry concentration and profit

Do SOEs take advantage of market concentration to increase profits? To consider this question, a profit margin is calculated by dividing the aggregate profits by aggregate revenues for state and non-state owners. This shows an average profit margin for the non-state sector of 6.5 per cent, compared to 6.2 per cent for the state sector. This accords with Lardy's observation on the basis of aggregate results that 'the profit margins of the two types of firms are virtually indistinguishable in the past few years' (Lardy, 2014, p. 26). That is, SOEs do not appear to be converting market concentration into monopoly rents.

Table 4-16 disaggregates profit margins according to different types of ownership and between concentrated and unconcentrated subsectors. This suggests that industry concentration is indeed related to higher profits. The average profit margin in concentrated subsectors is 7.4 per cent, compared to 6.1 per cent in unconcentrated subsectors. The profit margin of SOEs in unconcentrated subsectors is even lower at 5.2 per cent. Within the state sector, central SOEs in concentrated subsectors have the highest aggregate profit margins, although they are somewhat lower than the average profit margins of other ownership types.

Table 4-16 Aggregate profit margin by ownership and concentration

	Total Revenue (1000 RMB)		Profit (1000 RMB)		Profit Margin	
	U	C	U	C	U %	C %
SOE-Central	1,710,665,929	5,207,993,710	91,295,055	380,578,333	5.3	7.3
SOE-Local	5,573,376,545	2,676,226,258	284,195,621	182,955,091	5.1	6.8
State Subtotal	*7,284,042,474*	*7,884,219,968*	*375,490,676*	*563,533,424*	*5.2*	*7.1*
Collective	1,870,775,886	326,178,044	132,553,869	33,204,572	7.1	10.2
Private	21,495,584,153	800,419,859	1,371,067,905	53,271,467	6.4	6.7
Foreign	3,728,838,329	162,917,829	225,693,192	26,242,389	6.1	16.1
HMT	6,603,329,130	309,495,871	396,286,094	28,885,940	6.0	9.3
Other	2,574,294,429	217,573,779	176,297,791	13,780,960	6.8	6.3
Non-state Subtotal	*36,272,821,927*	*1,816,585,382*	*2,301,898,851*	*155,385,328*	*6.3*	*8.6*
All	43,556,864,401	9,700,805,350	2,677,389,527	718,918,752	6.1	7.4

Note (U) Unconcentrated, HHI < 0.1, (C) Concentrated, HHI > 0.1

Further consideration of profit measures across sectors reveals a more nuanced story, suggesting that different SOEs are indeed pursuing different objectives depending on the sector in which they are operating. Table 4-17 shows relevant statistics for the 20 largest subsectors by revenue (which account for 40 per cent of total industrial revenue and 38 per cent of total industrial profits).

Table 4-17 Profit measures of twenty largest subsectors

Four Digit Code	Industry Subsector	Revenue Share %	Profit Share %	Profit / Revenue %	Profit / Assets %	SOE Share of Assets		
						Central %	Local %	Total %
3230	Steel Rolling Processing	5.7	3.0	3.4	3.6	18	43	61
4420	Transmission and Distribution of Electric Power	4.0	0.8	1.3	0.9	80	20	99
2511	Crude Oil Processing and Petroleum Product	3.3	2.3	4.5	9.1	62	20	82
610	Bituminous Coal and Anthracite Mining and Washing	3.0	5.8	12.1	8.9	12	64	76
3721	Automobile Complete	2.9	3.6	7.9	9.9	33	55	88
3725	Automobile Parts and Attachments	2.2	2.8	8.0	9.9	4	12	16
4411	Thermal Power Generation	1.9	1.8	6.0	2.7	46	37	83
1711	Cotton and Chemical Fiber Spinning and Weaving Processing	1.8	1.4	4.8	6.9	1	7	8
1810	Apparel	1.8	1.7	6.0	10.2	1	2	3
4041	Computer Body	1.6	0.4	1.8	5.2	0	5	5
3351	Commonly Used Non-Ferrous Rolling Processing	1.6	1.3	5.2	9.2	8	9	16
3220	Steel Smelting	1.4	0.6	2.6	2.5	22	50	73
3931	Wire and Cable Manufacturing	1.2	1.0	5.4	8.8	1	5	5
710	Crude Oil and Gas Mining	1.2	5.7	30.9	15.5	89	8	97
4043	Computer Peripheral Equipment	1.1	0.7	4.1	8.3	2	4	5
4061	Electronic Components	1.1	0.8	4.3	5.9	1	11	12
3111	Cement	1.1	1.4	8.5	6.6	5	29	34
2614	Organic Chemical Material	1.0	0.6	3.9	4.2	26	23	49
1331	Edible Vegetable Oil Processing	0.9	0.7	4.8	9.1	3	9	12
1620	Cigarettes	0.9	1.8	13.2	13.2	92	8	100

The profit measures related to the largest potential monopoly – electricity – are very low. Conversely, the profit measures for oil and cigarettes are amongst the highest. The profit margin and return on assets for the (locally) state-owned automobile assembly subsector are higher than average, but not higher than the non-state 'automobile parts and attachments' subsector, which supports the proposition that the automobile subsector is not a state monopoly. Also notable is the relatively high profit margins in the locally SOE-owned, but unconcentrated, coal mining sector.

Given different potential state policy objectives, profit in the industrial sector is broken down into resources (two-digit industry codes below 12), manufacturing (two-digit industry codes between 13 and 42) and utilities (two-digit industry codes above 43).

Table 4-18 shows that the distribution of asset holdings by different types of ownership drives the returns to which they have access. Note that 4.1 per cent of non-state assets are invested in the high-yielding resources sector, compared to 16 per cent for SOEs. More than

92 per cent of non-state assets are invested in manufacturing, of which most are in unconcentrated manufacturing subsectors. Less than four per cent of non-state assets are in utilities, but this low-yielding sector makes up almost a third of SOE assets. The majority of local SOE assets are in manufacturing sectors (61 per cent), followed by utilities (23 per cent) and resources (16 per cent). Central SOE assets are skewed toward utilities (42 per cent).

Table 4-18 Distribution of assets by owner

		Resources		Manufacturing		Utilities		Total	
		C	U	C	U	C	U	C	U
SOE	Central	0.131	0.029	0.203	0.219	0.414	0.003	0.748	0.252
	Local	0.011	0.149	0.119	0.491	0.164	0.066	0.294	0.706
	Subtotal	0.067	0.093	0.158	0.363	0.282	0.037	0.508	0.492
Non-state	Collective	0.006	0.090	0.127	0.705	0.051	0.022	0.183	0.817
	Private	0.001	0.050	0.031	0.892	0.017	0.009	0.049	0.951
	Foreign	0.008	0.011	0.022	0.901	0.040	0.018	0.070	0.930
	HMT	0.000	0.006	0.037	0.924	0.020	0.013	0.058	0.942
	Other	0.002	0.047	0.049	0.844	0.042	0.017	0.093	0.907
	Subtotal	0.002	0.039	0.039	0.884	0.024	0.012	0.065	0.935
All		0.031	0.062	0.091	0.654	0.138	0.023	0.260	0.740

Note (U) Unconcentrated, HHI < 0.1, (C) Concentrated, HHI > 0.1

Table 4-19 shows that concentrated resources and manufacturing subsectors have higher profit margins than non-concentrated sectors – both SOEs and non-SOEs appear to convert market concentration into high profit. The reverse is true for central SOEs in the concentrated utilities sector (i.e. electricity) – a result opposite to what would be expected from a profit-maximising monopolist.

Table 4-19 Profit margins of subsectors by ownership and concentration

		Resources		Manufacturing		Utilities		Total	
		C	U	C	U	C	U	C	U
SOE	Central	0.24	0.20	0.06	0.04	0.03	0.07	0.07	0.05
	Local	0.19	0.09	0.08	0.04	0.05	0.01	0.07	0.05
	Subtotal	0.24	0.11	0.07	0.04	0.03	0.01	0.07	0.05
Non-state	Collective	0.11	0.14	0.10	0.06	0.09	0.05	0.10	0.07
	Private	0.13	0.12	0.06	0.06	0.09	0.06	0.07	0.06
	Foreign	0.51	0.09	0.11	0.06	0.15	0.09	0.16	0.06
	HMT	0.05	0.29	0.09	0.06	0.15	0.10	0.09	0.06
	Other	0.12	0.16	0.06	0.06	0.08	0.07	0.06	0.07
	Subtotal	0.24	0.13	0.08	0.06	0.11	0.07	0.09	0.06
All		0.24	0.12	0.07	0.06	0.04	0.05	0.07	0.06

Note (U) Unconcentrated, HHI < 0.1, (C) Concentrated, HHI > 0.1

4.4 Conclusion

After three decades of reforming the planned economy and opening up to world markets, China's industrial economy is now largely competitive. Nevertheless, the structure of the NBS survey data used to estimate market concentration mean have tended to understate market concentration, and failed to detect the large state monopolies that do remain. An analysis of 2009 data detects only 20 'highly concentrated' and 31 'moderately concentrated' industrial subsectors. Moreover, counting the number of subsectors doesn't give an indication of their economic significance. In total, the 51 subsectors identified as either moderately or highly concentrated cumulatively accounted for less than 2.5 per cent of total industrial revenue. Making adjustment to deem SOEs in the same subsector to be part of the same central or local SOE ownership group, identifies 22 additional potentially concentrated subsectors. These include the large central SOE monopolies continue in the electricity, oil and tobacco sectors. Collectively, these sectors accounted for almost 16 per cent of the total revenue of large-scale industrial firms in 2009.

Despite these limitations of the earlier studies, the overall finding that Chinese industry has in fact become highly competitive can be sustained. After adjusting for the existence of large SOE conglomerates, less than one quarter of Chinese industry can be characterised by having moderate-to-high degrees of market concentration. The automotive sector has a high degree of state ownership but falls short of monopoly. Even steel, which has become emblematic of SOE, is dominated by (local) SOEs but is characterised by a low degree of market concentration. This supports William's (2013) conclusion that the sector is highly competitive, in spite of central government attempts to consolidate the industry.

On average, SOEs operating in concentrated sectors have higher returns than those in non-concentrated industries. This is consistent with the expected behaviour of private profit-maximising firms. At first glance this appears to be consistent with the claim that monopolist SOEs exploit their market power to achieve excess profits.

But this chapter suggests that SOE behaviour is in fact contingent on the sector in which they operate. The profit margin varies markedly between sectors. State-owned resource companies in concentrated sectors have some of the highest profit margins – consistent with a policy of extracting resource rents on behalf of the state. By contrast, the some of the lowest profit margins are in concentrated utilities sectors under the control of central SOEs. Rather than the typical profit maximising monopolist that under-invests to drive up price, it appears that the state-owned utility company over-invests and drives up downstream economic activity. This opens the possibility that the foregone profits of some SOEs spill over into greater economic activity elsewhere. In this case, a narrow assessment of SOE performance based on profits in concentrated sectors will understate their broader economic contribution.

Chapter 5: SOE profitability and value-added in manufacturing

How do SOEs perform relative to non-SOEs in competitive markets for manufactured goods? The previous chapter showed that most of China's manufacturing subsectors tend to be highly competitive and dominated by private firms. In principle, this allows performance to be measured using a profit-based measure as a proxy for the return on capital, unconfounded by persistent rents (from monopolies or natural resources). Moreover, excellent statistical coverage (using the 2011–2013 waves of the above-scale industrial survey) allows profit and value-added measures to be calculated at the firm level, controlling for province and industrial subsector.

Investigating firm-level results makes it possible to consider some of the questions raised in Chapter 2. Does ownership still matter for those SOEs that are very small relative to the market, where SOEs continue to exist without obvious public policy justification? To what extent are SOEs "bigger" – as called for by Xi Jinping – and are bigger SOEs better or worse for profitability? If large SOEs are less profitable, could it be that the missing value recaptured by SOE management or workers, therefore reflecting a trade-off between profit maximisation and the achievement of other policy objectives (like winning favour for reforms or providing social stability, as suggested in Chapter 2)?

The results of this chapter are necessarily limited to SOEs in manufacturing – a relatively small and declining share of the SOE portfolio. It therefore does not address questions about whether state-ownership can be an effective at contributing to policy goals in sectors relating to services or network utilities. Nevertheless, given that China's largest manufacturing subsector relates to steel, and that Chinese steel SOEs are notorious for their poor profitability, it is worth considering whether steel SOEs are representative of SOEs more broadly, or whether they are a special case.

5.1 Measuring SOE performance

Access to large survey data has allowed assessments of the relative performance of SOEs over time. Jefferson, Hu, Guan and Yu (2003) considered the productivity and performance of 22,000 large and medium enterprises based on NBS survey data from 1994–1999. They estimated the multifactor productivity of SOEs compared to non-SOEs and showed that SOEs had the slowest productivity growth compared to other ownership forms over that period. However this analysis was not restricted to competitive manufacturing sectors. It included both utilities and resources companies.

Based on a World Bank Investment Climate Survey of financial data from 2002–2004 for 12,400 Chinese manufacturing firms in 125 Chinese cities, Dollar and Wei (2007) found that

the return on capital (whether measured in terms of profits per unit of fixed assets – described as the marginal revenue product of capital, or total value added per unit of fixed assets – described as the average revenue product of capital) for state-owned manufacturing firms was between 23 and 54 percentage points lower than comparable non-state firms. They interpret these lower returns as a distortion to the cost of capital, and therefore as a symptom of investment inefficiency.

Ding, Knight and Zhang (2016) calculated the same capital performance measures as Dollar and Wei (marginal revenue product of capital, and average revenue product of capital), but applies to the broader NBS survey data from 2000-2007, including 100,000 mining and manufacturing enterprises. They also found that SOEs were the least efficient users of capital, in that their returns were systematically lower than the returns of non-SOEs. The finding also holds on measures of both profit and total value added. Hsieh and Klenow (2009) use the ratio of profits to fixed assets in the industrial survey from 1998–2005 as an intermediate step to estimate firms' total factor productivity (TFP). For SOE manufacturers, total factor productivity is 41 per cent below that for non-SOEs. But they do detect a marked improvement in total factor productivity between 2002 and 2005, which they attribute to the exit of loss-making SOEs.

More recently, Wei and Rong (2012) used aggregate statistics from the Industrial Yearbook to estimate the technical efficiency of SOEs relative to non-SOEs from 2000-2009 according to a stochastic production frontier. Excluding non-competitive sectors (defined broadly, according to a CR-4 measure[29] in 2002), they argued that the technical efficiency of SOEs had converged with non-SOEs by the final two years of the survey – the average technical efficiency of SOEs in 2009 was 0.72 compared to 0.74 for non-SOEs. By contrast, estimates based on provincial-level data, and including SOEs across the non-agricultural economy including the health and education sectors, show no such convergence between 1985 and 2007 (Brandt, Tombe and Zhu, 2013).

These prior studies are widely cited but are based on data that does not capture the full effects of China's WTO accession, the effect of governance changes following the creation of the SASAC system, and the continued growth of private competition in Chinese manufacturing subsectors.

My unpublished working paper (Hubbard, 2015b) applied Dollar and Wei's methodology to the 2012 World Bank Enterprise Survey. The survey was restricted to 2,700 firms with private ownership and 148 wholly-state-owned enterprises from firms in only 25 mostly richer coastal Chinese cities. After excluding firms with missing observations, fewer than six per cent

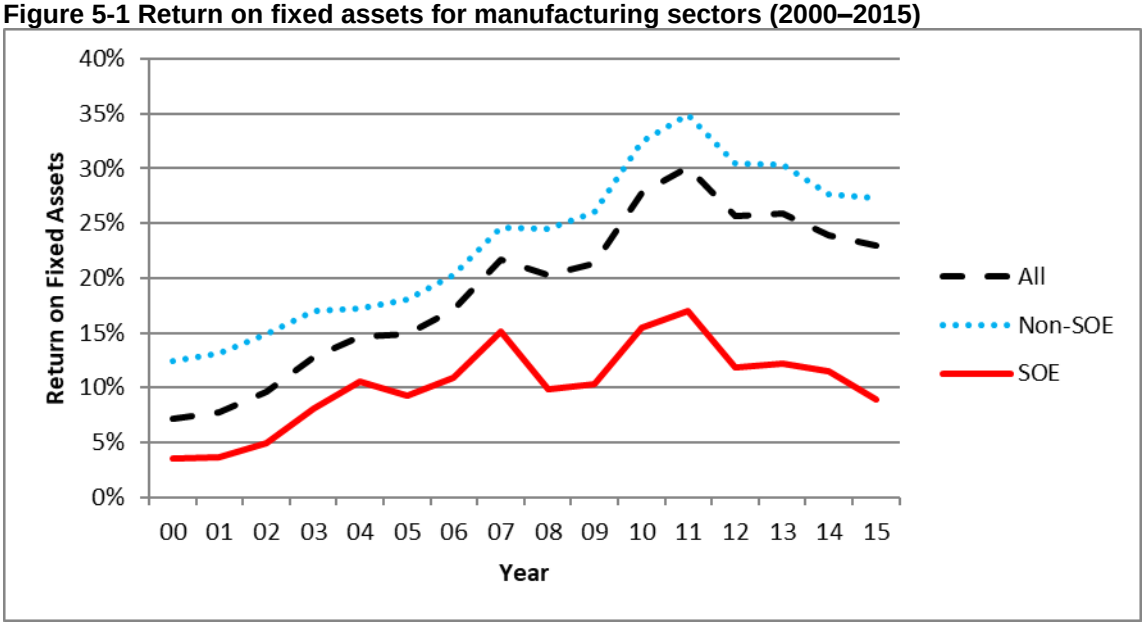
[29] The Concentration Ratio (CR)-4 measure considers the market share of the leading four enterprise in an industry. When the required data is available, the HHI is a preferable measure to measures, since it includes information on the broader distribution within a subsector, while still giving extra weight to the leading firms through the use of the square term (Hall and Tideman, 1967; Calkins, 1983).

of the 1,032 complete observations had any state ownership – further evidence of the retrenchment of SOEs from the manufacturing sector. In this sample, the difference in value added per unit of fixed capital between the six wholly state-owned enterprises and non-SOEs was not statistically significant. The difference between non-SOEs and the 48 majority SOEs was statistically significantly (at 5 per cent), with SOEs reporting *higher* value added per unit of fixed capital. Taken at face value, high capital returns would suggest underinvestment by state firms. While entirely unexpected, the small number of SOEs in this survey did not allow for too much confidence in the results.

The contribution of this chapter is to draw on the latest available above-scale industrial survey data, from 2011 to 2013. It follows the approach of Dollar and Wei (2007) in calculating capital returns for manufacturing firms, but uses the larger industrial survey. Following Hsieh and Klenow, the chapter considers profits, a broader return to capital (profits and depreciation), and total value added of manufacturers based on the total value of their fixed assets. While firm-level data on employee compensation is available, survey observations are not available for the number of workers. For this reason a stochastic production frontier analysis is not estimated.

The aggregate trends of manufacturing profits (excluding tobacco and petroleum sectors) divided by fixed assets are shown in Figure 5-1. The absolute rate of profit is higher (since fixed assets are necessarily smaller than total assets) but the overall trends between SOEs and non-SOEs are the same as previously observed in Figure 1-1. The dashed line shows the average return for all shifts over time from the solid SOE line at the start of the period, toward the non-SOE line at the end of the period, reflects the shifting weight in these sectors from SOEs to non-SOEs over this period.

Figure 5-1 Return on fixed assets for manufacturing sectors (2000–2015)



Source Author's calculations based on NBS, Statistical Yearbook various years.

5.1.1 Pooled enterprise-level survey data (2011–2013)

Does the large gap between SOEs and non-SOEs also emerge when considering firm-level statistics? This chapter employs the 2011–2013 waves of the annual above-scale industrial survey previously described in Section 4.1.1. Revised industry classifications CSIC (GB/T 4754—2011) are reported in the National Statistical Yearbook from 2012, and in the survey data from 2013. To ensure consistent industry classifications, all observations with 2011 industry revisions are converted using an official conversion table (National Bureau of Statistics of China, 2011). To avoid capital returns being confounded by monopoly or resource rents, resource (two-digit subsectors 12 or below) and utilities (two-digit subsectors 44 and above) industries are dropped, as well as state monopoly manufacturing subsectors – tobacco (two-digit sector 12) and oil processing (four-digit subsector 2511).

Observations are included for the book value of the firm's fixed assets, profits, depreciation, taxes on production, and employee compensation. Employee compensation is a broad measure of labour costs that includes wages, bonuses, allowances, subsidies, welfare expenses (including insurance benefits) and other monetary and non-monetary compensation (Ministry of Finance 2006). After 2007 the survey does not include separate observations for value added, but summing profits, depreciation, taxes on production and employee compensation provides a measure of value added, consistent with the methodology used in China's national income accounts (National Bureau of Statistics of China 2012). Observations for the firm's provincial location are missing for some years – this is recovered by identifying the province based on the leading two digits of the firm's postcode.

All observations are pooled for years 2011–2013.

Observations are dropped in the case of obvious errors where fixed assets are zero or negative, or fixed assets are greater than total assets.

Table 5-1 gives summary statistics for each of the key variables in the sample, broken down into SOEs and non-SOEs. Consistent with the findings of the previous chapter that China's manufacturing sectors are largely dominated by private firms, the table confirms that the sample is dominated by non-SOE manufacturers – SOEs account for three per cent of firm-year observations. But SOEs on average are larger – accounting for 23 per cent of total fixed assets in the sample. The median SOE, measured in terms of its fixed assets, is more than four times larger than the median non-SOE. Median results for value added and its components are all between two and five times larger for SOEs than non-SOEs.

Table 5-1 Summary statistics, manufacturing firms (2011–2013)

	(Million RMB)						Obs.
	Mean	Median	Max	Min	Sum	Std. Dev.	
Fixed Assets							
Non-SOE	50.2	12.6	52,632.6	0.0	34,389,249.4	317.3	684,498
SOE	463.0	54.0	107,441.4	0.2	10,467,184.6	2,360.0	22,605
Total	63.4	13.0	107,441.4	0.0	44,856,433.9	529.9	707,103
SOE / Total	7.3	4.1	1.0	199.0	0.23		0.03
Value Added							
Non-SOE	42.9	13.1	58,798.1	0.0	29,383,060.2	242.6	684,498
SOE	268.8	43.5	118,031.7	0.1	6,077,105.0	1,703.6	22,605
Ratio SOE/Non-SOE	6.3	3.3	2.01	28.00	0.21		
Of which: Profits							
Non-SOE	17.6	3.6	24,370.5	-888.1	12,015,762.2	105.1	684,498
SOE	94.4	8.5	59,633.4	-2,490.0	2,133,637.8	840.1	22,605
Ratio SOE/Non-SOE	5.4	2.4	2.45	2.80	0.18		
Depreciation							
Non-SOE	6.7	1.1	11,335.4	0.0	4,556,746.9	58.9	684,498
SOE	48.8	4.9	10,339.0	0.0	1,102,543.3	278.4	22,605
Ratio SOE/Non-SOE	7.3	4.6	0.9	1.0	0.2		
Taxes							
Non-SOE	7.8	2.0	26,687.6	-2,287.1	5,355,064.1	65.7	684,498
SOE	56.3	5.5	38,877.0	-917.0	1,273,707.7	525.4	22,605
Ratio SOE/Non-SOE	7.2	2.7	1.46	0.40	0.24		
Compensation							
Non-SOE	10.9	3.9	14,673.6	0.0	7,455,487.1	62.6	684,498
SOE	69.3	15.0	13,082.3	0.0	1,567,216.2	314.7	22,605
Ratio SOE/Non-SOE	6.4	3.9	0.89	1.00	0.21		

Table 5-2 reports average performance of SOEs and non-SOEs measured according to profit per unit of fixed assets (equivalent to the return on fixed assets measure reported in Figure 5-1), combined profit and depreciation per unit of fixed assets (the return on capital, equivalent to Dollar and Wei's marginal revenue product of capital), and total value-added per unit of fixed assets (equivalent to Dollar and Wei's average revenue product of capital measure). Comparisons are presented as a ratio, and also a log-difference between the two results to facilitate comparison with the regression results below.

Table 5-2 Aggregate return on fixed assets

	Sum Profits / Sum Fixed Assets	Sum (Profits + Depreciation) / Sum Fixed Assets	Sum Value Added / Sum Fixed Assets
Non-SOE	0.35	0.48	0.85
SOE	0.2	0.31	0.58
Ratio SOE / Non-SOE	*0.58*	*0.64*	*0.68*
Log Difference	-0.54	-0.44	-0.39

These results suggest that, on average, SOE manufacturers earn 20 RMB worth of profits per 100 RMB of fixed capital investment, compared to 35 RMB per 100 RMB investment by non-SOEs. This suggests that the profitability of SOE manufacturers is around half that of non-SOEs. This gap closes somewhat when depreciation is considered (noting from the previous table that SOEs face relatively larger depreciation bills than non-SOEs). In terms of total value added, on average non-SOEs produce 85 RMB of value added per 100 RMB of fixed assets, which closes the performance gap to around 40 per cent.

5.2 Statistical Results

Table 5-3 presents the mean and median returns for each of the SOEs and non-SOEs in the sample. In all cases the mean results are much higher than the median results, with the median results being closer to the aggregate results. This is a result of the market mechanism by which loss-making firms tend to be removed from the market. Thousands of smaller firms, some of which have very high profitability, survive in the market,[30] which pulls up average *firm* profitability, but corresponding loss-making firms are not observed since these would go out of business. The performance of the median SOE and non-SOE firm provides a more reliable guide to overall performance, more closely matching the aggregate performance results from the previous table. The median SOE earns 18 RMB in profit on every 100 RMB of fixed capital, compared to 31 RMB for non-SOEs. But the proportional difference closes to around a third based on value-added measures.

Table 5-3 Mean and median return on fixed assets

	Profit / Fixed Assets		(Profit + Depreciation) / Fixed Assets		Value Added / Fixed Assets	
	Mean	Median	Mean	Median	Mean	Median
Non-SOE	0.60	0.31	0.74	0.44	1.87	1.14
SOE	0.44	0.18	0.58	0.31	1.53	0.83
Ratio SOE/Non-SOE	0.73	0.59	0.78	0.69	0.82	0.73
Log Difference	-0.31	-0.53	-0.25	-0.37	-0.34	-0.31

To what extent do these results reflect the poor performance of SOEs at the firm level, compared to a potentially higher concentration of SOEs in less profitable subsectors, or more depressed regions? This lower rate of return might be explained by the concentration of SOEs in less profitable subsectors, or specific regions, where rates of return are lower. This effect of sectoral and regional variation can be reduced using simple regression analysis.

Table 5-4 reports the results of three separate panel least-squares regressions. In each case the dependent variable is the log of each of the three different performance measures reported in

[30] Smaller firms have a smaller ratio of non-fixed assets to total assets.

the previous table. Performance variables are estimated based on the profit divided by fixed assets, profit and depreciation divided by fixed assets, and value added divided by fixed assets. Logs of these performance variables are taken from subsamples trimming the top and bottom tails of observations to remove negative observations and extreme outliers – this removes the top and bottom 11 per cent of observations in the case of the profit measure, the top and bottom five per cent of observations for profits and depreciation measures (this recovers some unprofitable firms that are excluded in the straight profit measure), and the top and bottom two per cent for the value-added measure.

Independent variables include fixed effects dummies for all China's provinces, each four-digit industry subsector, and the year. A dummy variable takes a value of one if the firm is an SOE – hence the coefficient on the dummy variable can be interpreted as the log-difference (approximate to the percentage difference for small values) in performance of SOEs relative to non-SOEs, after controlling for regional and subsector distribution.

Table 5-4 Panel least-squares regression results, no size controls

Dependent Variable	Log (Profit / Fixed Assets)		Log ((Profit + Depreciation) / Fixed Assets)		Log (Value Added / Fixed Assets)	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Constant	-1.32	0.00	-0.81	0.00	0.14	0.00
SOE Dummy	-0.28	0.00	-0.25	0.00	-0.23	0.00
Province Fixed Effects	Y		Y		Y	
4-Digit Subsector Fixed Effects	Y		Y		Y	
Year Fixed Effects	Y		Y		Y	
Observations	675,328		710,198		768,490	
R-squared	0.04		0.04		0.09	
Adjusted R-squared	0.04		0.04		0.09	

The coefficient of –0.28 in the regression of profit indicates that the average profitability of manufacturing SOEs is around a quarter below non-SOEs. The smaller coefficient of -0.23 in the value-added regression suggests the performance gap is still around 20 per cent on the value-added measure. This suggests that the observed poor performance of manufacturing SOEs is not primarily determined by regional or sectoral distribution of SOE fixed assets.

To what extent does size matter? The most conspicuous feature of SOEs in the descriptive statistics is their large size. The next section considers the performance of SOEs according to their small and great. It then considers the suggestion made in Chapter 2 that profits might be foregone to achieve other objectives.

5.3 Returns for manufacturers with relatively small market shares

This subsection considers those manufacturing firms facing the fiercest competitive environment – these firms are selected from amongst the smallest five per cent of manufacturers measured according to their share of total revenue in their subsector. For the year 2013, this provided 15,078 observations of firms, including 131 SOEs, with a revenue share for their four-digit industry subsector less than 0.003 per cent. There are 23 four-digit subsectors represented in this sample. The most common are firms primarily producing auto parts (5,172 firms), woven cloth manufacturing (3,790 firms) and steel pressing (2,494 firms). The large number of very small firms in these sectors suggests market conditions that may be as close as is practicably feasible to textbook perfectly competitive conditions.

Table 5-5 reports the performance measures these SOEs and non-SOEs. The gap between SOE and non-SOE performance appears to have closed significantly – indeed the value-added measures suggest that SOE performance may be slightly higher.

Table 5-5 Performance measures of manufacturing firms with small national market share

	Profit / Fixed Assets		(Profit + Depreciation) / Fixed Assets		Value Added / Fixed Assets	
	Mean	Median	Mean	Median	Mean	Median
Non-SOE	0.40	0.21	0.54	0.33	1.99	1.06
SOE	0.39	0.18	0.56	0.31	2.17	1.12
Log Difference	-0.04	-0.16	0.04	-0.06	0.18	0.06

Table 5-6 reports the result of three separate regressions, including controls for province, industry subsector and year.

Table 5-6 Panel least-squares regression results, competitive SOEs

Dependent Variable	Log (Profit / Fixed Assets)		Log ((Profit + Depreciation) / Fixed Assets)		Log (Value Added / Fixed Assets)	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
Constant	-1.42	0.27	-0.52	0.59	0.03	0.98
SOE Dummy	0.01	0.92	0.07	0.23	0.09	0.10
Province Fixed Effects	Y		Y		Y	
4-Digit Subsector Fixed Effects	Y		Y		Y	
Year Fixed Effects	Y		Y		Y	
Observations	27,357		28,232		28,232	
R-squared	0.03		0.03		0.16	
Adjusted R-squared	0.02		0.03		0.16	

In all cases the coefficient on the SOE dummy is positive but not statistically significant. In other words, this can be interpreted as suggesting that the performance of small SOEs operating the most competitive manufacturing subsectors is statistically equivalent to that of non-SOEs. This is an important result because it suggests that there *are* competitive conditions in which SOE performance can converge to non-SOE performance. In other words, SOE underperformance is not inevitable; at least in certain circumstances competition might triumph over ownership. Identifying the circumstances under which this occurs is an important subject for future research, relevant to designing corporate governance arrangements for those SOEs for which the state owner's sole objective is to maximise its financial returns.

5.4 Returns for the largest manufacturers

Having shown that both profitability and value-added measures of *some* SOEs can be equivalent to non-SOEs, how can the large differences between aggregate SOE and non-SOE performance be explained? One suggestion, from Chapter 2 (Section 2.2) is that the lower cost of capital for SOEs leads SOEs to invest more than non-SOEs and therefore become much larger than private companies facing the higher competitive cost for capital. This can be explored by grouping firms based on fixed asset size.

Table 5-7 reports for 2013 the number and total fixed assets of SOEs and non-SOEs grouped below median size (first to fiftieth percentile), above median size excluding the top percentile (fifty-first to ninety-ninth percentile), and the top (hundredth percentile). This shows that of the 7,515 SOEs in the sample, roughly a tenth of these sit within the top percentile of all manufacturing firms. These include 188 central SOEs and 537 very large local-level SOEs.

Table 5-7 Distribution of manufacturing fixed assets (2013)

	Fixed Asset Size by Percentile			
	1-50	51-99	Top	Total
Number				
SOE	1,552	5,238	725	7,515
Central SOE	*235*	*1,037*	*188*	*1,460*
Local SOE	*1,317*	*4,201*	*537*	*6,055*
Non-SOE	116,670	127,356	1,871	245,897
All	118,222	132,594	2,596	253,412
Total Fixed Assets (RMB Million)				
SOE	8,975	728,236	2,888,808	3,626,018
Central SOE	*1,340*	*165,239*	*828,002*	*994,581*
Local SOE	*7,635*	*562,997*	*2,060,806*	*2,631,438*
Non-SOE	642,740	8,496,908	4,134,822	13,274,470
All	651,715	9,225,144	7,023,630	16,900,489
Share of Total Fixed Assets (%)				
SOE	0.1	4.3	17.1	21.5
Central SOE	*0.01*	*1.0*	*4.9*	*5.9*
Local SOE	*0.05*	*3.3*	*12.2*	*15.6*
Non-SOE	3.8	50.3	24.5	78.5
All	3.9	54.6	41.6	100.0

The distribution of fixed assets between SOEs and non-SOEs of different sizes reveals why the top percentile is particularly important – because this percentile of manufacturing firms in our sample accounts for 40 per cent of the fixed assets. SOE assets are particularly concentrated in the largest SOEs – of the 3.6 trillion RMB of SOE fixed assets, 2.8 trillion (80 per cent) are accounted for by SOEs in the top percentile. Consequently, 80 per cent of the aggregate mean result for SOE performance will be determined by these 725 largest manufacturing SOEs. For non-SOE manufacturers, only 40 per cent of their aggregate results will be explained by manufacturers in the top percentile; half (50.3 per cent) of all manufacturing assets sit within non-SOE manufacturers that are above median size but not in the top one percent.

The median profitability on fixed assets of large SOEs is eight per cent – just above the benchmark 'official interest rates of loans of financial institutions' for loans of longer than five years, which between 2011 and 2013 was officially between 6.55 and 7.05 per cent (National Bureau of Statistics of China, 2015, secs 19–6). By contrast large non-SOE manufacturers had a return on fixed assets of around 13 per cent, roughly double the benchmark rate. But the proportional gap in percentage terms narrows when considering value added measures – the lower returns for large non-SOEs close the SOE-non-SOE gap to eight per cent at the mean (from 18 per cent in aggregate), and 15 per cent at the median (from 27 per cent in aggregate). This is evidence of continued dual-track pricing of capital for SOEs (see section 2.2).

Table 5-8 shows the various performance measures for SOEs and non-SOEs within this top percentile. All measures – both for these very large SOEs and non-SOEs – are much lower than

the results summarising the averages for all firms reported in Table 5-3. This is because larger firms (with lower average returns) dominate the distribution. The results for SOEs in this table are almost identical to the results for SOEs in aggregate reported in Table 5-2, confirming the observation made from the previous table that aggregate SOE manufacturing returns will be dominated by the returns of the largest SOEs in the sample.

Table 5-8 Returns on fixed assets for top percentile of manufacturing firms

	Profit / Fixed Assets		(Profit + Depreciation) / Fixed Assets		Value Added / Fixed Assets	
	Mean	Median	Mean	Median	Mean	Median
Non-SOE	0.25	0.13	0.39	0.26	0.61	0.42
SOE	0.20	0.08	0.30	0.18	0.56	0.36
Ratio SOE/Non-SOE	0.79	0.60	0.78	0.67	0.92	0.86
Log Difference	-0.23	-0.50	-0.25	-0.40	-0.08	-0.15

Table 5-9 provides a brief survey of the most significant SOEs within the largest sectors that accounted for 80 per cent of the fixed asset investment of all large SOEs in 2013. For example, 68 steel pressers account for 29 per cent of fixed assets. The table also shows the coefficients for labour and capital from individual estimates of Cobb-Douglas production functions for each of the subsectors. This makes it possible to check whether the lower returns might be explained by decreasing returns to scale in the particular industry – in this case, the sum of labour and capital shares is significantly less than one. The results suggest that while some manufactured products (nitrogenous fertilizer, inorganic alkali, coking, paper and paperboard, liquor, and auto parts) do have production technologies with decreasing returns to scale, this is not the case for the largest subsectors, which exhibit constant or even possibly increasing returns to scale in this sample.

Table 5-9 Cobb-Douglas estimates for industries with large SOE manufacturers

	Share of large SOE fixed assets	Number of large SOEs	Labour Share	Capital Share	Sum	Reject CRS
Steel Pressing	29.0	68	0.64	0.39	1.03	***
Integrated Automobiles	11.4	63	0.62	0.36	0.98	-
Steel Smelting	6.5	8	0.55	0.44	0.99	-
Organic Chemical Materials	4.5	31	0.58	0.40	0.98	*
Cement	4.0	73	0.62	0.38	0.99	-
Nitrogenous Fertilizer	3.7	36	0.59	0.32	0.91	***
Primary-form Plastic and Synthetic Resin	3.0	22	0.62	0.38	1.00	-
Photoelectron Parts and Other Electronic Parts	2.8	20	0.68	0.28	0.96	***
Copper Smelting	2.4	7	0.64	0.49	1.13	***
Inorganic Alkali	2.0	14	0.55	0.35	0.89	***
Coking	1.4	20	0.54	0.37	0.91	***
Machine-made Paper and Paperboard	1.3	14	0.62	0.33	0.94	***
Liquor	1.2	6	0.59	0.34	0.93	***
Auto Parts and Fittings	1.0	16	0.64	0.32	0.96	***
Phosphoric Fertilizer	1.0	5				
Railway Engines and Groups of Conveying Vehicles	1.0	11				
Iron Smelting	1.0	4	0.52	0.47	0.99	-
Metal Ships	1.0	14	0.61	0.32	0.92	***
Tyre Production	0.9	15	0.60	0.33	0.93	***
Compound or Mixed Fertilizers	0.9	11	0.63	0.37	1.00	-
Subtotal	80.0	458				
Of which: Increasing	31.4	75				
Constant	31.2	212				
Decreasing	15.4	155				

Note Reject null hypothesis of constant returns to scale (CRS) with 1% confidence (***), 5% confidence (**), 10% confidence (*).

Table 5-10 presents three new regressions, this time with separate dummies to account for size – the reference case is for manufacturing firms below median size with separate dummies for manufacturers above median size but not in the top percentile, and manufacturing firms in the top percentile. There are three additional interaction variables for SOEs in different size categories. The negative coefficients on the size variables show that manufacturers with larger fixed assets also tend to have lower profits per fixed assets, as already noted.

Table 5-10 Panel least–squares regression results, size controls

Dependent Variable	Log (Profit / Fixed Assets)		Log ((Profit + Depreciation) / Fixed Assets)		Log (Value Added / Fixed Assets)	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Constant	-1.09	0.00	-0.57	0.00	0.55	0.00
50-99 percentile FA	-0.43	0.00	-0.48	0.00	-0.83	0.00
Top percentile FA	-0.85	0.00	-0.75	0.00	-1.36	0.00
SOE x 1-49 percentile FA	0.02	0.24	0.08	0.00	0.31	0.00
SOE x 50-99 percentile FA	-0.18	0.00	-0.18	0.00	-0.01	0.39
SOE x Top percentile FA	-0.33	0.00	-0.30	0.00	-0.05	0.02
Province Fixed Effects	Y		Y		Y	
4-Digit Subsector Fixed Effects	Y		Y		Y	
Year Fixed Effects	Y		Y		Y	
Observations	623,100		706,362		706,362	
R-squared	0.07		0.09		0.26	
Adjusted R-squared	0.07		0.09		0.26	

The interaction terms are most relevant: the profitability of SOEs below median size is not significantly different from those of similarly sized non-SOEs. This is supports the proposition that it is the difference in profitability amongst the largest SOEs that drives the poor relative aggregate performance of SOEs.

For those SOEs in the largest percentile of manufacturing firms, the coefficient on the SOE interaction term suggests that financial profits of those SOEs are around a third lower than non-SOEs in the largest percentile. But on the value-added measure much of that gap closes – the total contribution to value added per unit of fixed capital in these largest SOEs is now only five per cent lower than correspondingly large non-SOEs. The difference is statistically significant at the five percent level, but no longer at the one per cent level. Similarly, there is no statistically significant difference in value added between SOEs and non-SOEs amongst manufacturing firms above median size when measured on a value added rather than profit basis.

5.5 Distribution of value added within SOEs

To what extent are large SOEs missing profits captured in other components of their value added? Table 5-11 shows the distribution of value added amongst the largest manufacturing firms in the sample for the year 2013. It shows that, out of the total distribution of value added, SOEs account for a full five percentage points less in profits and depreciation. However, they also account for an additional six percentage points of value added in taxes, and four percentage points in compensation to workers. The final row shows that, had the value added of these large SOEs been fixed but redistributed in the same way as for non-SOEs, profits would have been higher by 71 billion RMB, and depreciation higher by 79 billion – with a 90 billion RMB reduction in taxes and a 60 billion RMB reduction in value added. In this case, the mean

profitability of the largest SOEs would be adjusted upward 17.6 per cent to 20.0 per cent, coming very close to the 20.7 per cent figure for the largest non-SOE manufacturers in the same year.

Table 5-11 Composition of value added amongst top percentile of manufacturing firms (2013)

	Profits	Deprec.	Taxes on Production	Employee Comp.	Value Added	Fixed Assets	Profits / Fixed Assets (%)
Billion RMB, 2013							
Non-SOE	856.6	571.6	399.6	455.2	2,283.0	4,134.8	20.7
SOE	507.7	307.3	360.2	367.9	1,543.0	2,888.8	17.6
Shares of Value Added (%)							
Non-SOE	38	25	18	20	100		
SOE	33	20	23	24	100		
Difference (percentage points)	-5	-5	6	4	-		
Hypothetical, applying Non-SOE shares to SOE Value Added							
SOE (Hypothetical)	579.0	386.3	270.1	307.6	1,543.0	2,888.8	20.0

Potential reasons for differences between SOEs in shares of value added between depreciation, taxes and employee are now considered in turn. The finding that are smaller share of SOE value added is accounted for by depreciation can be further explored by considering the depreciation rate for SOEs and non-SOEs. Table 5-12 shows the mean depreciation rate for different sized manufacturing firms, by dividing depreciation by the previous year's fixed assets. It shows that while across the whole sample SOEs and non-SOEs have an average depreciation rate of around 13 per cent, the depreciation rate for SOEs in the largest percentile of fixed assets is 3.5 percentage points lower than non-SOEs.

Table 5-12 Depreciation Rate of Fixed Assets, Manufacturing Firms (2012–2013)

	Percentile of Fixed Assets			
	1-50	51-99	Top	All Sample
Non-SOE	14.3	12.1	13.7	13.2
SOE	18.0	11.6	10.2	12.8
All	14.4	12.1	12.6	13.2

This difference may be partly explained by considering the different incentives facing state owners and non-state owners. One way that a private owner might seek to maximise financial returns on assets would be to minimise or avoid tax to the greatest possible extent. One long-standing way of doing this is to depreciate assets as quickly as possible, thereby increasing the tax deduction, allowing more value added to be distributed as profit (Lardy, 1998, p. 53). By contrast, the state owner (in the absence of agency problems) would be indifferent to receiving income from taxation as from ownership, as the two modes are substitutes.

A consequence of a lower depreciation rate amongst large SOEs would be a tendency for the book value of SOE assets to be higher than the book value of non-SOE assets that have been written down at a faster rate. As this effect builds up over time, even if SOEs and non-SOEs operate with the same efficiency, performance measures based on book value of assets will be relatively worse for SOEs, since the denominator is lower. Research focusing on technical efficiency rather than financial returns should re-estimate asset values based on a perpetual inventory method (Brandt, Van Biesebroeck and Zhang, 2014, pp. 346–347); this is not attempted here because 2010 data is missing.

SOEs appear to claim less in depreciation, but do pay a higher share of their value added in taxation. This is consistent with other empirical evidence supporting the finding that SOEs are less inclined to minimise tax than non-SOEs. Based on analysis of 2,054 publicly listed Chinese companies from 1999–2012, Bradshaw, Liao and Ma (2016) show that listed SOEs, and in particular those that are ultimately controlled by local governments, are less likely to avoid taxes than listed private companies. They explain this based on the incentives facing SOE managers, whose performance evaluation is partly based on the tax paid by their SOE (Bradshaw, Liao and Ma, 2016, p. 25). By contrast, Liu and Liu (2013), based on a shorter analysis of listed firms between 2003 and 2006, suggest that SOEs actually face a lower tax burden as a form of government paternalism, by receiving higher tax refunds under the value added tax.

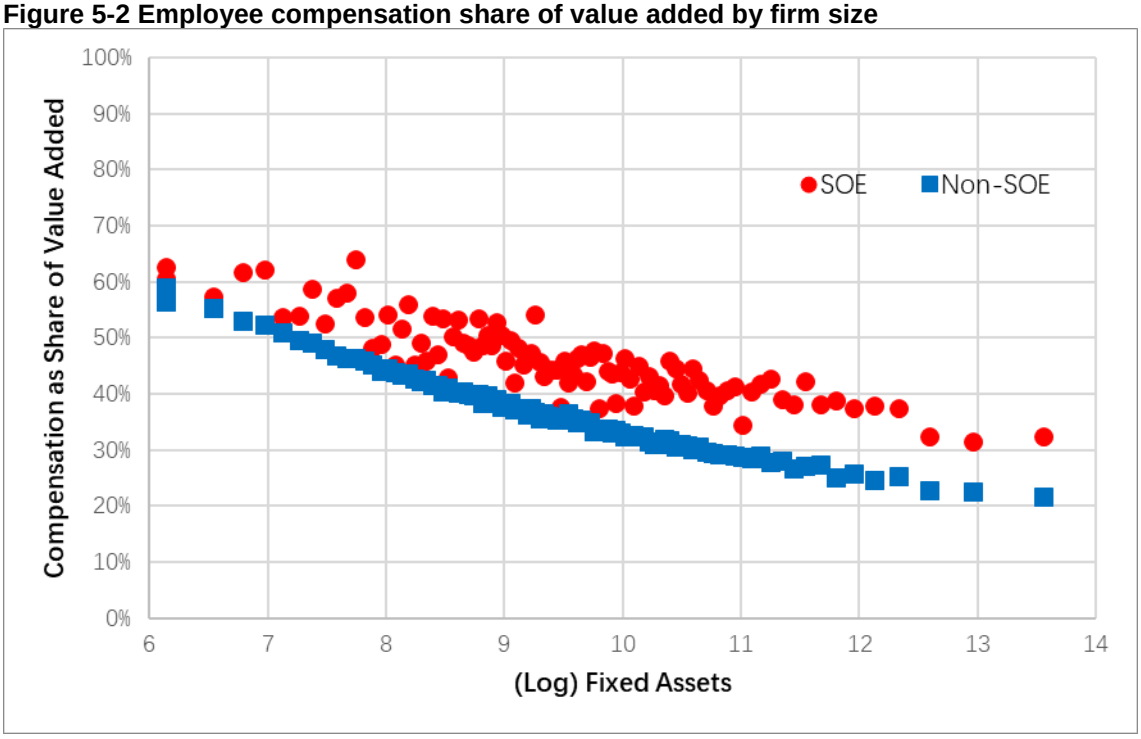
It is possible for both motives to apply, depending on the type of SOEs. Table 5-13 shows that on average across the entire sample of manufacturing firms, both central SOEs and local SOEs have a higher tax share of value added than non-SOEs. Amongst the ten central SOEs operating with very small market share (considered in Section 5.3) the tax share of value added is still higher than average, but the 120 local SOEs in this subsample on average pay slightly less in tax. By contrast, the tax take of the 188 central SOEs and 537 local SOEs operating in the top percentile of manufacturing firms shows that both pay significantly more in tax than non-SOEs.

Table 5-13 Tax share of value added, for manufacturing firms (2013)

		Subsample	
	All Sample	Smallest Revenue Share	Top Percentile Fixed Assets
Non-SOE	19.0	16.6	17.5
Central SOE	22.2	17.9	24.0
Local SOE	21.6	15.5	23.0
All	19.4	16.6	19.9
Number of observations			
Non-SOE	246,207	11,371	1,871
Central SOE	1,463	10	188
Local SOE	6,062	120	537
All	253,732	11,501	2,596

Also offsetting the lower share of value added paid as profits, SOEs also tend to distribute a higher share of value added to workers through labour compensation. Figure 5-2 shows the employee compensation share of total value per unit of fixed capital. The figure shows that overall the smallest firms, whether or not SOEs, have the highest share of value added going to labour. Firms with the largest fixed assets make the smallest relative payments to labour. SOEs of any given size tend to pay a higher share of value added to employees. The bigger the capital investment, the larger the gap. For the top percentile of manufacturers by fixed assets, 21 per cent of the value added of non-state manufacturers is paid to employees compared to 31 per cent for SOEs.

Figure 5-2 Employee compensation share of value added by firm size



Because the survey data does not include observations for the number of employees in each firm, it is not possible to tell whether the higher share of value added to labour is the result of SOEs employing more workers than non-SOEs (over-manning) or paying a similar number of workers a higher amount. The two explanations are not mutually exclusive. Evidence from a panel of 700 SOEs in the 1990s suggests that over-manning was endemic during that period (Dong and Putterman, 2003). A survey of 6,000 workers taken in 1995 similarly found that SOEs paid significantly higher wages and were generally less responsive to changes in market conditions (Hering and Poncet, 2010).

The aggregate data for the manufacturing sector calculated from the 2012 China Statistical Yearbook provides more recent insights (see Appendix B). In all but one of the 29 sectors, the average value of fixed capital per worker was much higher in SOEs. In the steel sector (smelting and pressing of ferrous metals), which employed 1.4 million state employees (compared to 936,000 non-SOE employees), the average value of fixed capital per employee was 758,000 RMB ($US117,000). This was roughly three times the equivalent figure for privately controlled steel works. An even larger sector for employment is the manufacture of transport equipment (including automobile manufacturing), in which 1.9 million state employees used an average of 288,000 RMB ($US45,000) per worker. This was more than double the average for the 1.5 million employees in the same sector outside of state ownership. The one exception at a two-digit level is state manufacture of textiles, wearing apparel, footwear and caps, where SOE employment is negligible (73,400 SOE employees compared to 1.5 million non-SOE employees).

Overall, it appears that large SOEs do have lower profits and rates of depreciation than non-SOEs. But the fact that the distribution of value-added varies between SOEs and non-SOEs, means that observed lower profits need not necessarily implied low value-added. It appears that at least some of the missing profits could be captured in taxes or payments to workers that would be higher than expected in non-SOEs. This suggests that the state owners might indeed have a different distributional preference to the private owners. This suggests that where possible the economic contribution of SOEs should be judged from a complete observation of value-added, rather than being inferred from partial (profit) measures.

This is not to claim that an efficient market allocation of capital between SOEs and non-SOEs has actually been achieved. The fact that large SOEs' observed rate of profitability might *understate* their actual return on capital suggests only that their raw profitability measure is a poor measure of performance. But this by no means implies that capital has been allocated efficiently between competing uses. Moreover, the tendency of SOEs to make higher payments to workers would create distortions elsewhere. In regions where SOEs are big employers, this could attract labour away from the private sector, bidding up private sector costs at the expense of private sector growth in those regions.

If efficiency *is* to be achieved through market mechanisms, as per the stated goal of the *Decision*, then the information available to the market is inadequate for market processes to select out poorly performing SOEs. In the absence of this market pressure, it is highly unlikely that most, or even many, SOEs are operating at the efficient frontier.

5.6 Pressing sector-specific problems

This section considers the sector-specific aspects of large SOE capital returns.

Table 5-14 reports the results of regression analysis on a subsample of the largest manufacturing firms, with separate interaction terms between SOEs and each four-digit subsector. The results are presented in descending order, showing the interactions for the twenty largest subsectors based on the total fixed asset investment of large SOEs (accounting in 2013 for 355 large SOEs and 83 per cent of the fixed assets of large SOEs). A complete table of interactions for results for all sectors is included for reference in Appendix C.

The results show that in almost all subsectors (cement, liquor, copper smelting and auto-parts), large SOEs are less profitable than large non-SOEs. But much of this apparent difference in performance declines greatly, often to the point that the difference is no longer statistically significant, when the difference in value added per unit of capital is used (final column). Most conspicuously, the largest subsector for SOE manufacturers – steel pressing (accounting for 52 SOEs in the top percentile of manufacturing firms, and 27 per cent of the fixed assets of large SOEs in the top percentile) – has significantly poorer performance on all measures.

Table 5-14 Subsector-specific SOE dummy coefficients, for top percentile of manufacturing firms

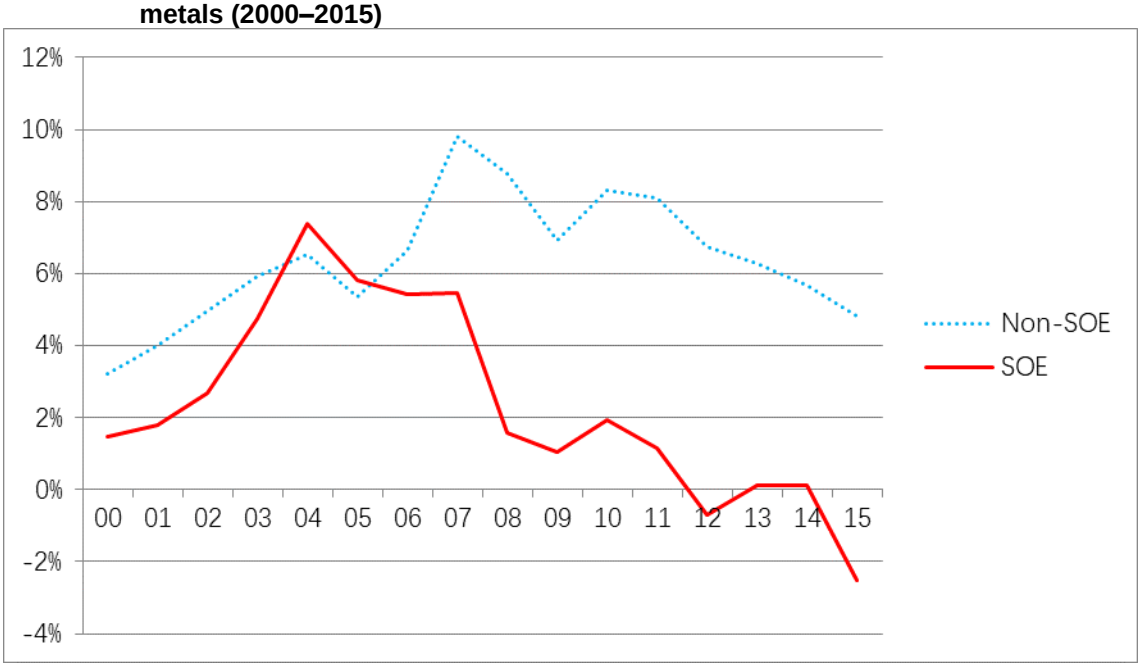
Dependent Variable		Log (Profit / Fixed Assets)		Log ((Profit + Depreciation) / Fixed Assets)		Log (Value Added / Fixed Assets)	
		Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
Constant		-2.28	-	-0.73	-	-0.22	-
SOE x	Steel Pressing	-1.20	-	-0.71	-	-0.43	-
SOE x	Integrated Automobiles	-0.02	0.91	0.10	0.35	0.25	0.01
SOE x	Steel Smelting	-1.12	-	-0.35	0.05	0.02	0.89
SOE x	Organic Chemical Materials	-0.24	0.15	-0.17	0.14	-0.05	0.66
SOE x	Cement	0.23	0.05	0.11	0.16	0.13	0.09
SOE x	Photoelectron Parts and Other Elec. Parts	-0.20	0.36	-0.31	0.04	-0.52	-
SOE x	Copper Smelting	0.33	0.49	0.52	0.11	0.20	0.51
SOE x	Nitrogenous Fertilizer	-0.25	0.23	-0.20	0.17	-0.01	0.95
SOE x	Primary-form Plastic and Synthetic Resin	-0.22	0.28	-0.33	0.02	-0.17	0.18
SOE x	Inorganic Alkali	-1.24	-	-0.81	-	-0.56	-
SOE x	Liquor	0.79	0.03	1.07	-	1.02	-
SOE x	Auto Parts and Fittings	0.01	0.95	0.05	0.70	0.24	0.06
SOE x	Phosphoric Fertilizer	-0.22	0.79	0.40	0.48	0.13	0.80
SOE x	Metal Ships	-0.61	-	-0.43	-	-0.30	0.02
SOE x	Communication System Equipment Mfg	-0.18	0.69	-0.32	0.32	-0.49	0.10

SOE x	Machine-made Paper and Paperboard	-0.14	0.54	0.04	0.80	0.23	0.11
SOE x	Tyre Production	-0.76	-	-0.49	-	-0.15	0.31
SOE x	Petroleum Extraction Equipment	-0.77	0.13	-0.48	0.17	0.10	0.75
SOE x	Coking	-1.19	-	-0.88	-	-0.56	-
SOE x	Potassic Fertilizer	-0.48	0.52	-0.86	0.10	-0.59	·
SOE x	115 other 4-digit subsectors	Y		Y			Y
Province Fixed Effects		Y		Y			Y
4-Digit Subsector Fixed Effects		Y		Y			Y
Year Fixed Effects		Y		Y			Y
Observations		5,287		5,287			5,287
R-squared		0.23		0.27			0.32
Adjusted R-squared		0.18		0.23			0.28

The other subsector in which large SOEs perform very badly relates to the manufacturing of photoelectron parts (solar cells) – another sector which had received substantial policy support since 2006, and was at the time facing 'a severe manufacturing surplus' coupled with a saturated export market and weak domestic demand (Honghang *et al.*, 2014).

Lardy (2014, pp. 125–128) highlighted steel as an important heavy industrial sector in which the performance of state firms is inferior to that of private ones. It remains the most prominent case in which 'industrial overcapacity' began in 2010 to cause major trade frictions with the United States (Tang, 2010). Figure 5-3 shows that the return on assets in the steel sector collapsed after 2007 and was barely breaking even for the period of this study.

Figure 5-3 Aggregate return on assets for smelting and pressing of ferrous metals (2000–2015)

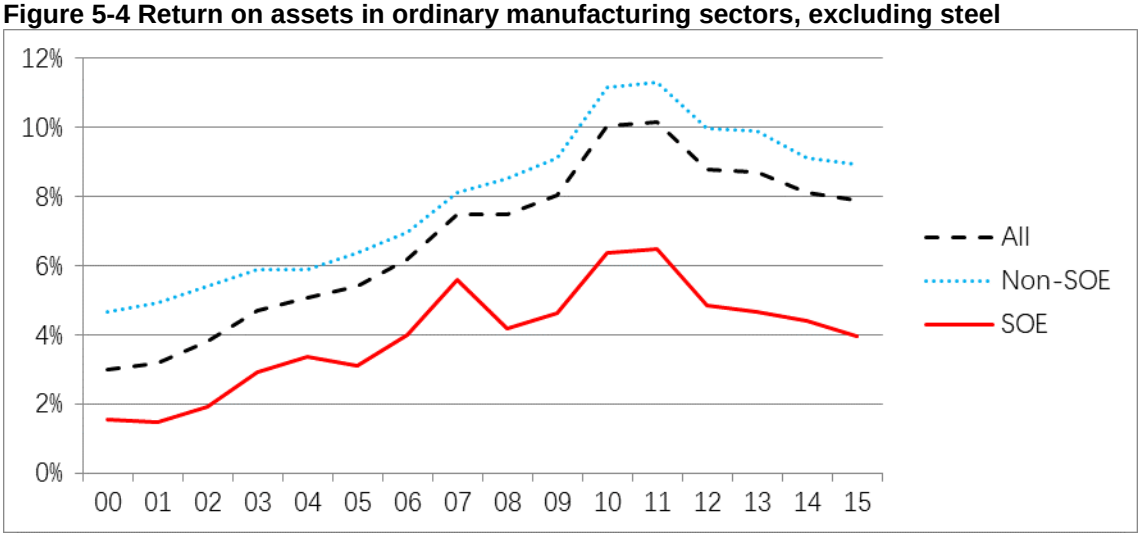


Source Author's calculation based on NBS, Statistical Yearbook (various years), adapted and updated from Lardy (2014, p. 127)

Figure 5-4 shows the aggregate return on assets for competitive manufacturing sectors, excluding the steel sector. Removing steel closes the gap between SOE and non-SOE profits by a full percentage point. Finally, while the profit gap between SOEs and non-SOEs does widen slightly over time, the relationship between SOE and non-SOE manufacturing profits is relatively stable over time when contrasted with the apparent convergence and then wide divergence observed in Figure 1-1.

In other words, it appears that the key to understanding much of the aggregate volatility depends on understanding the dynamics of the large and volatile steel sector. Manufacturing SOEs in general (that is, excluding steel) are much less volatile. Care needs to be taken not to over-generalise results from the steel SOEs to manufacturing or industrial SOEs in general.

Figure 5-4 Return on assets in ordinary manufacturing sectors, excluding steel

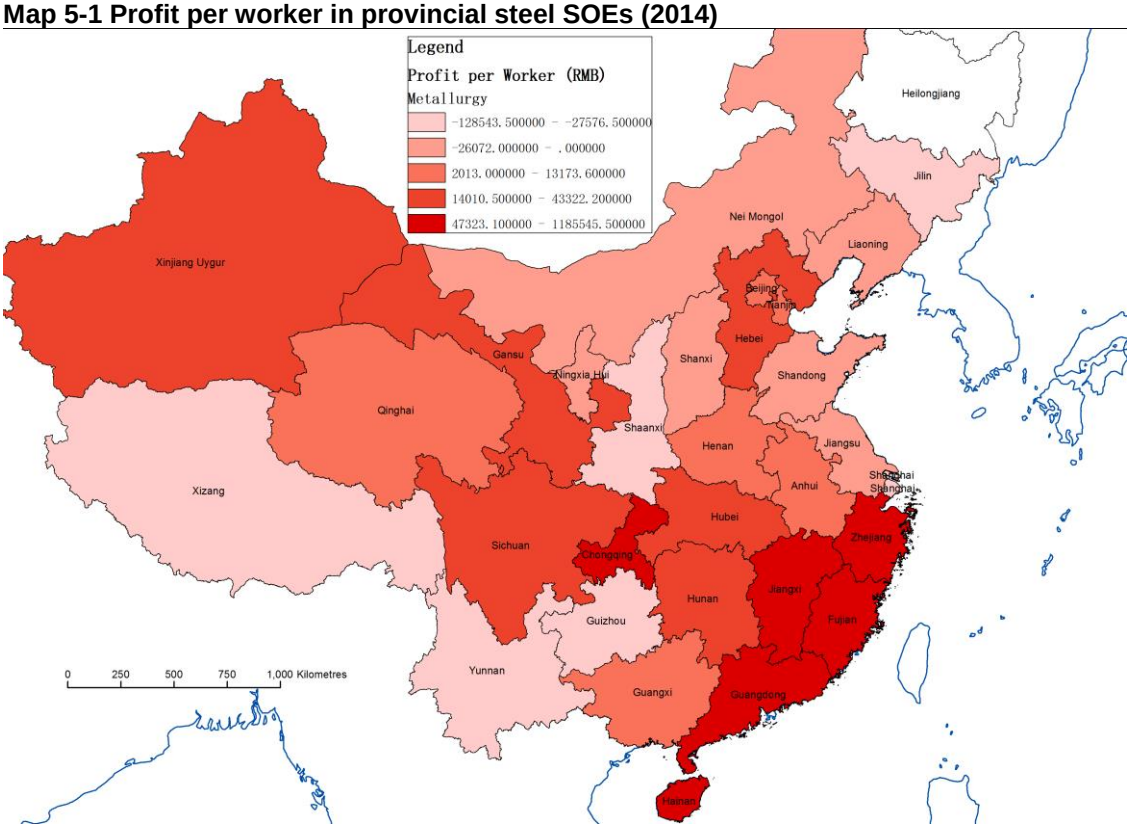


Source Author's calculation based on NBS, Statistical Yearbook (various years)

Section 1.2 noted the importance of steel in terms of China's industrial policy under the planned economy and in the period of reform that followed. Steel was designated a nationally important 'pillar' industry in 2005 (Williams, 2013; Qi, Song and Liu, 2016). And steel remains the most significant industrial sector for Chinese SOEs. One third of SOE workers in competitive manufacturing sectors belonged to industry sectors relating to steel or automobiles. Amongst the largest SOEs, Table 5-5 shows that 46.9 per cent of the value of fixed assets pertains to 139 very large SOEs involved in steel pressing, integrated automobiles and steel smelting subsectors.

Even amongst SOEs, the problem of steel appears to be geographically concentrated. Map 5-1 shows the average profit per worker for provincial SOE steel SOEs, as reported in the SASAC Yearbook. The lightest two shades on the map show where the profit per worker is negative. While profits are high in the rich coastal provinces, returns in central China and inland are much lower.

Map 5-1 Profit per worker in provincial steel SOEs (2014)



Source Author's calculations based on SASAC (2015, pp. 713–766)

One of the reasons why the steel industry may be a special (albeit large case), is the political and economic importance of coal and steel to some regions of China. Table 5-15 shows that half of the assets for provincial coal and steel SOEs are in Shanxi, Shandong, Hebei, Henan and Shaanxi. Moreover, in Shanxi, Hebei and Henan, these coal and steel SOEs account for almost three quarters of provincial SOE assets. Provincial governments' commitment to their local steel SOEs have stymied central government attempts to rein in steel production since 2005 (Haley and Haley, 2013, p. 59).

Table 5-15 Leading provinces for coal and steel provincial SOE assets

	SOE Industrial Assets (Billion RMB)	Of which coal and steel	(%)	Share of all provincial SOE coal and steel (%)	(Cum.)
Shanxi	2,192.3	1,600.3	73	17	17
Shandong	2,000.7	1,126.7	56	12	29
Hebei	1,089.9	795.7	73	8	37
Henan	987.1	720.1	73	8	45
Shaanxi	1,397.1	673.9	48	7	52
Beijing	1,690.8	506.7	30	5	58
Anhui	931.4	471.0	51	5	63
Liaoning	861.8	426.9	50	5	67
Gansu	599.5	421.9	70	4	72
Tianjin	808.2	387.6	48	4	76
Other Provinces	8,582.3	2,268.2	26	24	100
All Provinces	21,141.0	9,398.8	44	100	

Source (China Ministry of Finance, 2015)

5.7 Conclusion

It is clear that the aggregate rate of profitability of SOEs in China's (largely competitive) manufacturing sectors is well below that of non-SOEs. However, the aggregate results do not mean that all SOEs are inefficient. Using enterprise level survey data reveals that there are hundreds of SOEs that are small relative to the market, whose measures of profit or value-added per unit of capital are around the same as non-SOEs.

Nevertheless, the competitive performance of some smaller SOEs are overwhelmed by the fact that most SOE manufacturing assets are concentrated in a few very, very large SOEs. The 2013 survey identifies 7,515 manufacturing SOEs out of more than a quarter of a million manufacturers, or less than 3 per cent by number. SOE manufactures control 21.5 per cent of manufacturing fixed assets – and the largest 725 SOE manufacturers control 17.1 per cent. So the profitability of the largest 725 manufacturers determines four-fifths of the aggregate SOE performance results.

These large SOEs do have lower profits – however, the distribution of value added for large SOEs appears to be different than for large non-SOEs. They distribute less value added as profits or depreciation, but these are offset by higher payments of taxes, and higher payments to employees. This suggests that a profit measure under-estimates their economic contribution. This is consistent with the idea that the state owner does have different objectives to the private profit-maximising capitalist, which may focus on broader contribution to economic activity. It is potentially willing to forego financial profit to achieve economic or social benefits elsewhere, as suggested in Chapter 2.

Nevertheless, this offers only a partial apology for SOEs. While it suggests that the gap between SOE and non-SOE profitability in Figure 1-1 overstates the real performance

difference between ownership types, it also calls attention to potential distortions they may create elsewhere (in the labour market) and confirms the claim that SOEs – even when facing competitive markets for output – still face different objectives and constraints compared to non-SOEs. Large SOEs may not be as bad for the economy as they appear at first glance. But unless they face the same price signals and selection pressures as non-SOEs any convergence to competitive market outcomes would be purely coincidental.

Amongst these large SOEs it is worth paying special attention to the steel sector. Four-fifths of SOE manufacturing fixed assets are in just 725 large SOEs. Of these, 52 SOEs are in the steel pressing subsector account for 27 per cent of the total value of fixed assets. In other words, SOE steelmakers disproportionately affect the aggregate performance results of SOEs. SOE steel-makers do appear to be chronic under-performers, even when considering broader value-added measures. There is a regional dimension to this as well – suggesting that some state owners are prepared to tolerate losses from their steelmakers.

Getting to the bottom of this phenomenon requires some study of the role of the steel industry still plays in parts of China – possibly related to the need to provide employment in less prosperous parts of China. Given its significance both to the Chinese economy, and its spillovers to the global economy, the Chinese steel industry is well worthy of its own separate study (Hogan, 1999; Tang, 2010; Song and Liu, 2012; Williams, 2013). However, care needs to be taken to ensure that the analysis and policy recommendations that apply to China's SOE steel makers aren't generalised or mis-applied to SOEs overall.

Chapter 6: Conclusions and implications

This thesis began with focus on the apparent tension in the 'socialist market economy' between achieving market efficiency and maintaining state ownership. Given that a founding tenet of Communism is to abolish private property, some degree of continued rhetorical support for state ownership on the part of the Party's General Secretary is understandable. Yet this commitment to make SOEs bigger, better and stronger – as well as the emergence of China's SOEs as some of world's biggest companies and investors – appears to conflict with the historical record of ongoing retrenchment of the role of SOEs in the economy. The poor and declining relative profitability of SOEs in China's industrial economy has been cited by many careful observers of the Chinese economy to support the proposition that rather than making the economy better and stronger, Chinese SOEs are bad for efficiency. Some go further to argue that the persistence of state influence in the Chinese economy, partly through SOEs, means that China's economy cannot properly be considered to be a 'market economy'.

This thesis provided a contemporary empirical assessment of the nature of SOEs in the Chinese economy that suggests that this is not the case. SOEs no longer play their old role as administrative units of the state under the planned economy. While still connected to parts of the state through ownership and personnel ties, they have become independent entities that, in those sectors where competition is viable, they are subject to fierce competition from private and foreign firms. However, state ownership does remain dominant, by default, in those sectors, such as natural monopoly sectors, where free competition is less successful. In this sense, the state does maintain a dominant role in key sectors of the economy, even though SOEs do not dominate the entire economy. But state ownership is itself diffuse and fragmented – modern SOEs are often subsidiaries of other SOEs, and in many cases the line between state ownership and private ownership is blurred through 'mixed capital' arrangements.

One of the external criticisms of SOEs is that they do not engage in commercial behaviour in the manner of private firms – in the language of economics, they pursue objectives other than the maximisation of private profits. When SOEs fail to achieve rates of profit as high as non-SOEs, this is taken of proof either of 'non-commercial' behaviour or inefficiency. But before viewing this as an indictment against SOEs, it is worth considering the conditions under which profit maximisation is itself a socially desirable goal. Chapter 2 argued that, in a world of perfect competition, perfect information and no public goods or unpriced externalities, profit maximisation is sufficient to maximise social welfare. From an efficiency perspective, there would be no case for state intervention. Profit maximisation by private actors would sufficient, and its abuse could be kept in check by competition by other profit-seekers.

Under these circumstances, profit may be a good measure of SOE performance, given that there would be no particular case for SOEs to be doing anything else. There is no policy case to support an SOEs that cannot maintain profitability in a competitive market. But if an SOE can remain profitable under such conditions there is no policy case to abolish it, particularly if the state has an ideological presumption in favour of state ownership. The finding in Chapter 5 that some smaller SOEs do continue to exist in highly competitive markets – and apparently receive equivalent returns to non-SOEs there, suggests that this is at least possible, if not typical of the state sector.

For welfare economists, private property and profit maximisation is not an end in itself, but a means to an end of social welfare. In the real world, competition is not always sufficient to ensure socially desirable outcomes. State intervention is accepted to help remedy market failures – the case of natural monopoly being a common example. Such state intervention in the free market can take the form of regulation of private businesses – in effect constraining the profit-maximising objective. An alternative means of intervention is through an SOE with an explicit public-interest objective. In principle, whether an enterprise is a public enterprise or a private enterprise is secondary to the question of whether the enterprise contributes to social welfare. The fact that a state owner may be willing to forego so of its potential profits to achieve some other socially-desirable goal is not itself an indictment of the SOE. Indeed, where the state is deliberately using state ownership as an instrument to further certain social, political or developmental goals, then a profit-measure that excludes the value of these public policy objectives is likely to understate their value.

That said, the problems of measuring the value of policy outputs, and monitoring SOE management to ensure that they act for the public interest rather than for their personal enrichment, introduces principal-agent problems.

The public policy justification for the maintenance of SOEs in non-competitive sectors helps explain the distribution of SOEs revealed in Chapter 3. China's largest sector – and the source of most of China's exports – is manufacturing. After four decades of reform and opening up to global markets, sector is now largely dominated by non-SOEs. At the other extreme, those sectors which are characterised either by persistent rents (such as resources) and natural monopoly (such as network utilities), are shown here still to be the domain of SOEs. Finance, which tends to be highly regulated in any country, is also dominated by state firms. It is not surprising that China's massive SOE conglomerates are also central SOEs in these sectors. But it would be a mistake to take these as representative of all sectors. The existence of SOEs in sectors such as transport, education and health is also not uniquely Chinese. If the current state share of fixed-asset investment is a good guide to future output, then only around one-third of Chinese GDP will be produced by state enterprise in the future. This level would be higher than in many advanced economies, but not outrageously so.

The large central SOEs conglomerates that appear on the Global Fortune 500 list should also not to be taken as representative of SOEs in general. There are a few exceptionally large SOEs that attract much attention, and that dominate aggregate results. For some purposes – such as the study of Chinese elite politics (Brødsgaard, 2012) – they may be the only SOEs that matter. Shambaugh (2014, p. 170) might accuse China's powerful oil SOEs of 'hijacking' Chinese foreign policy, and drawing China into foreign entanglements that it would otherwise avoid – and for such a study it is only necessary to look at a few massive central SOEs. But it says little about the wealth or power of a local SOE operating in an expanding service sector. More than half of state capital is held at a local level. Provincial, township, county and even district-level SOEs are abundant and unlikely ever to become 'national champions'. Chinese SOEs, like people, are diverse. Simply identifying an enterprise as 'state-owned' does not say much about the enterprise, nor its importance to the national economy.

Having argued that profit measures may be an appropriate measure of performance in competitive markets, Chapter 4 set out to measure the extent of market concentration in Chinese industry. China's industrial sector has been well studied due to the availability of high-quality survey data. But it can be misleading to consider the sector as a whole since it includes not only manufacturing (China's largest economic sector, and dominated by non-SOEs, as revealed in Chapter 3) as well as resources and utilities (which are much smaller, but are dominated by some of China's most prominent SOE conglomerates). After making adjustments to account for the existence of these conglomerates, the chapter showed that manufacturing subsectors – with the exception of the state tobacco monopoly – are marked by a low market concentration and a low degree of state ownership. Resources (oil) and utilities (electricity) by contrast are marked by a high degree of market concentration and significant state ownership. SOEs in different sectors appear to respond to market concentration in different ways – resource companies in concentrated sectors tend to increase profits, consistent with an attempt by the state to capture resource rents. By contrast, SOEs in utilities sectors have the lowest level of profitability. This is consistent with non-profit objectives – but not necessarily inefficient[31] considering the downstream economic spillovers from this kind of infrastructure activity.

Chapters 3 and 4 showed that China's manufacturing sector was largely privately dominated, and not over-run by state monopolies. Nevertheless, a rump of SOEs do remain here despite four decades of reform and opening up. Given that the private-good nature of most manufactured goods, and the success of private competition in this sector, this comes closest to the case where profit-maximisation is a desirable social objective. Under these circumstances a direct profit comparison between SOEs and non-SOEs in the same subsector is most meaningful.

[31] If short-run marginal-cost pricing is taken as an efficiency benchmark, there is no requirement that fixed-costs need to be recovered. There may even be an efficiency case for a capital subsidy given that average cost pricing, or a two-part tariff create distortions of their own.

The results of the analysis in Chapter 5 for the years 2011-2013 find some SOEs that are small relative to the overall market which have profits that on average are close to those of non-SOEs. It appears possible for SOEs to be competitive. There is no particular case to maintain state ownership in such sectors. However, provided that these SOEs can keep up with the competition without subsidy, there is no real reason to abolish them. It simply would not matter for the Chinese economy.

But SOE fixed assets in the manufacturing sector are concentrated in the very largest SOEs. They have low rates of profitability relative to similarly large non-SOE manufacturers. It is their performance that determines the aggregate poor profitability of manufacturing SOEs. This suggest that Xi Jinping's calls for SOEs to become 'bigger' will not tend to make them 'better or stronger' – at least if this is measured in terms of profit. However, a close look at the distribution of value added amongst these large SOEs suggest that state owners' motivations are not in fact to maximise profits. As a share of their total value-added, large SOEs pay out less in profits and claim less in depreciation but distribute more in taxes and pay out more to their workers. This opens the possibility that the lower relative profits of large SOE manufacturers is not so much symptomatic of missing output, but rather that the state has different distributional preferences to the private profit-maximising owner. In the absence of a broad social safety-net, perhaps state owners care about social stability? Or perhaps the Party prefers to distribute state resources to its political supporters? In either case it is the distributional consequences – rather than the efficiency effects – that might be the best way to understand Xi's support for SOEs.

The fact that the performance of big manufacturing SOEs may not be quite as bad as suggested by their poor profitability figures should not be taken as evidence that they are achieving efficient market outcomes. The *Decision* emphasised the need for 'market rules, market prices and market competition' to maximise market efficiency. Even if it were the case that manufacturing SOEs and non-SOEs faced similar market prices and rules in their (competitive) output markets, the evidence suggests that they do not face the same rules and prices for their factor inputs. Bringing the price of state capital at last onto the same track as the competitive market price is China's major unfinished economic reform. Doing away with those capital subsidies that have no economic justification will identify those 'zombie firms' (Tan, Huang and Woo, 2016) that otherwise hold back China's economy.

This thesis has identified the steel sector as the home of many of these zombies. The history recounted in the Chapter 1 showed that steel has long been symbolic of industrial strength in China. Chapter 4 showed that, unlike most of Chinese manufacturing, steel subsectors tend to be locally-state-owned, and highly competitive. The results of Chapter 5 showed that large SOE steel presses had very low profitability relative to large non-SOEs. And while the low profits of other large manufacturing SOEs could be offset when considering broader value-added measures, this was not the case for steel.

The dynamics of China's steel sector deserves its own detailed study; the findings of this thesis suggest that such a study should focus on distributional effects and regional employment. Other countries have, throughout their history, at times had state-owned steel makers, possibly because of the scale of capital investment required for efficient steel-making. However, there appears to be no reason in principle while China's provinces cannot retreat and leave steel production to private producers, as is the case for most Chinese manufacturing. There may be a case for 'bigger, better and stronger' Chinese steelmakers, but the abysmal profitability and value-added figures relative to private firms suggest that there should be far fewer of them. Local owners may be propping up 'zombie' manufacturing SOEs for the sake of non-profit objectives, such as propping up regional employment in some places. But it can be a grossly inefficient means of doing so. Putting in place alternative policy measures to support regions, or workers, may provide the desired distributional outcomes, without distorting the industrial structure and giving rise to the international trade frictions.

6.1 Implications for reform

The thesis has argued against a generic conception of a 'state sector' in favour of considering the performance of SOEs in sector-specific contexts. There are some sectors, such as those with a tendency to natural monopoly or public good characteristics, in which free competition between profit-seeking firms does not result in socially efficient outcomes. State intervention, whether directly as owner or indirectly as regulator, is commonplace even in such sectors even in economies that are otherwise committed to private enterprise and free market competition.

While SOEs remain associated with uncompetitive and some otherwise problematic sectors, there is danger in confusing the correlation of SOEs in problematic non-competitive sectors, with the claim that SOEs cause problems and necessarily harm competition.

If further reforms can be undertaken to reduce artificial barriers to entry to introduce new competition (whether foreign or domestic) then this should be done. But if free competition is not possible – for example, due to natural monopoly characteristics of the industry – then regulation in the public interest remains desirable. Whether this is done by way of direct public ownership with clear public policy mandates, or whether it is done through the regulation of a private monopoly is a second order concern. In the case of China, ongoing ideological commitment to public ownership, as well as the problems of effective governance in a system with a weak rule of law, the public monopoly is likely to remain the lesser of two evils.

While Chinese reformers have been willing to embrace private competition when pragmatic to do so, it seems they hesitate to entrust large resource SOEs, systemically important financial SOEs, or operators of critical infrastructure networks to private ownership. This is unlikely to change.

To find, in the case of China, that monopoly sectors are populated by SOEs and that monopolised sectors are also inefficient, is not proof that SOEs are necessarily inefficient. To see whether the ownership problem is causal, the appropriate test is to consider whether privatising the public monopoly would lead to demonstrably better outcomes. Depending on the taxation arrangements chosen, the conversion of a public monopoly into a private monopoly may change the distribution of monopoly rents from public to private hands. But there is no clear efficiency gain if the causes of monopoly remain. The incentive problems that might arise from the state colluding as both owner and regulator might be avoided, only to be replaced by attempts of the new, private, profit-seeking owners to capture regulators themselves (Stigler, 1975).

Ongoing ownership reforms to categorise SOEs into those that are purely competitive (profit driven) and those with additional policy objectives are therefore important; careful specification of fewer policy objectives is preferable if the state owner intends effectively to monitor the SOE (Naughton, 2017, p. 296). For those SOEs with no explicit public policy objective, it may be necessary to ensure allocative efficiency for the state owner to demand the full competitive return on capital.

Where SOEs are retained – or expanded – as an instrument of state policy, the policy goals should be made explicit, and the metrics for whether or not these are achieved need to be carefully specified. This evaluation is made more difficult by the fact that the social, political and developmental goals favoured by the Party may not be consistent with the normative preferences of outsiders – whether Chinese citizens, western economists, or foreign governments. The problems of monitoring vague and sometimes competing policy objectives may not lead to maximum output, but not all missing SOE profit may be due to shirking and waste.

Without sector-specific reforms that focus on particular market structures, externalities and public policy considerations inherent in specific contexts, privatisation could result in a ‘crony market economy’ that is potentially more distorting and problematic. Conversely, what remains of ‘public ownership’ today is likely more efficient than the now-defunct SOEs that have been abandoned over the course of economic reform and concentrated in sectors in which private competition amongst profit-maximising firms cannot be relied upon to deliver desired results.

Given the potential to redistribute economic resources through SOEs, the reform of SOEs also has political implications. To the extent that politically connected managers can avoid regulation by politically weaker regulators, by inducing the state to erect new barriers to entry and opposing economic reforms that would reduce their market position, the politically-appointed manager has strong incentives to oppose otherwise beneficial economic reforms. These are the ‘vested interests’ about which Chinese reformers complain (Shambaugh, 2016).

The dynamic costs of protecting an existing monopoly can be more significant than the static welfare loss of the monopoly itself (Tullock, 1967). But from a broader political-economy perspective, the Party may be prepared to tolerate some of this dynamic inefficiency, and therefore longer-term growth, in the interests of maintaining political stability in the short term.

Political winners and losers from reforms touching on ownership are likely to be a primary consideration. The evidence from the previous chapter suggests that reforms that aim to increase SOE profits would tend to redistribute income away from other sources, unless accompanied by additional measures that tackle the underlying inefficiencies.

6.2 Implications for future research

Much of the empirical evidence and study of state ownership has taken place in a time of rapid transition. Much of what is conventionally known (SOEs are inefficient) and theorised (the soft budget constraint) dates from this time. These propositions need to be re-tested over time as markets and regulatory structures evolve together.

The political role of SOEs in capturing and redistributing rents is worthy of further study. While China's economic progress has been impressive, it is also worth remembering that the institutions for regulating a market economy are also under construction. The continued use of state ownership as a 'second best' instrument for achieving certain policy objectives is likely, particularly given the default ideological preference for public ownership. Assessing China's economic reforms based on institutional convergence with a private market economy is to misunderstand the destination.

Most importantly, different economic sectors have evolved in different ways. Those sectors closest to the ideal of perfectly competitive markets for private goods – China's competitive manufacturing sector – have flourished. Private competition has now displaced the dominant role of the state. SOEs remain dominant in sectors that tend to be confounded by intractable public policy problems including externalities, public goods and natural monopolies. Whether in China or elsewhere, state intervention in such sectors remains common, ranging from indirect regulation to outright ownership. Nevertheless, the largest manufacturers – including China's largest steelmakers – are SOEs. This contributes to a misperception of SOE dominance in Chinese manufacturing

The wealth of publicly available data available through data subscription services on publicly listed SOEs similarly gives rise to very many highly useful studies that provide insights into the behaviour of a subset of SOEs without revealing insights into their non-listed parent companies. Ongoing policy reforms to extend open government information to SOEs will help provide further information on these non-listed SOEs that will be useful for further research (Hubbard and Xiao, 2017). Beyond existing data subscription services, there is much further

data analysis that can be drawn from the official yearbooks (including SASAC Yearbook, China Finance Yearbooks) and other Chinese-language sources.

The empirical basis for re-testing propositions about SOEs is also changing. As a legacy of the planned economy, China's industrial sectors have been very well covered by official statistical reporting – yet the industrial share of GDP is in retreat as China's economy develops. Better measurement in the industrial sector is possible (the focus of Chapters 3 and 4), but there is a risk of over-generalising this to try to explain SOE performance overall. The challenge of assessing SOE involvement and performance in the services sector is compounded by the fact that for many services, particularly social services, it can be difficult to conceptualise, let alone measure, the value of inputs or outputs of the process. Without competitive 'private' benchmarks against which to judge SOE behaviour, it is also difficult to understand what observations relate from that part of the institutional arrangement of 'public ownership', and what parts come from other factors, such as uncompetitive market conditions, the existence of rents or social service obligations.

In terms of handling data for research, a key theme of this study is the emphasis that SOEs fulfil different functions in different sectors, making it difficult to interpret industrial aggregates that mix natural monopolies with natural resources and competitive manufacturing firms. Depending on the application, a more thorough analysis of a few leading SOEs might be enough to explain most of the aggregate results.

One particular challenge is to conceive of a simple objective to use when modelling for SOEs. As argued in this thesis, profit maximisation is a sound assumption about firm behaviour for representative firms operating without subsidy in perfectly competitive markets. This profit maximisation assumption in turn determines the distribution of payments to various factors of production – providing a relationship between the wage and the marginal product of labour, and the rental cost of capital. But these assumptions may not hold in the case of SOEs – given the longstanding objection to SOEs – is that they do not maximise profits, and either act in non-competitive markets or receive (sometimes implicit) subsidies. As a consequence, the standard interpretations may not apply – for example, low profits need not *necessarily* imply a low marginal return on capital.

In any case, neither the China's economy nor politics is likely to be static. It will, however, remain consequential to the world economy. It is complex. Labels to understand the Chinese economy – whether 'socialist market economy', 'state capitalist', 'Sino-capitalist' or 'state-led economic model' – are sometimes helpful shorthand. But they can be misleading. Ongoing research on the nature and performance of China's SOEs will be essential to understanding a part of the global economy that is here to stay.

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Appendix A: Potential concentration of all industrial subsectors (2009)

Industry Subsector		HHI		Share of all industrial revenue	SOE share of subsector assets (%)			Dominant Ownership
Code	Name	Raw	Pot	(%)	Central	Local	Total	
610	Bituminous Coal and Anthracite Mining and Washing	0.01	0.05	3.03	12	64	76	Local SOE
620	Lignite Mining and-Or Washing	0.06	0.08	0.17	14	30	44	Non-SOE
690	Other Coal Mining and Washing	0.21	0.21	0.00	0	14	14	Nonstate
710	Crude Oil and Gas Mining	0.1	0.83	1.17	89	8	97	SOE-Central
790	Support Activities for Oil and Gas Mining	0.07	0.6	0.31	82	11	94	SOE-Central
810	Iron Ore Mining	0	0	0.63	5	28	33	Non-SOE
890	Other Ferrous Metal Ore Mining	0.06	0.06	0.04	5	22	27	Non-SOE
911	Copper Ore Mining	0.01	0.03	0.05	4	45	49	Non-SOE
912	Lead, Zinc Ore Mining	0.06	0.06	0.14	0	42	42	Non-SOE
913	Nickel, Cobalt Ore Mining	0.07	0.09	0.01	3	0	3	Non-SOE
914	Tin Ore Mining	0.08	0.08	0.01	0	31	31	Non-SOE
915	Antimony Ore Mining	0.07	0.11	0.00	0	71	71	SOE-Local
916	Aluminum Ore Mining	0.1	0.22	0.02	68	0	68	SOE-Central
917	Magnesium Ore Mining	0.03	0.03	0.01	0	0	0	Non-SOE
919	Other Common Non-Ferrous Metal Ore Mining	0.04	0.04	0.01	2	6	8	Non-SOE
921	Gold Ore Mining	0.04	0.04	0.20	4	40	44	Non-SOE
922	Silver Ore Mining	0.28	0.28	0.01	0	17	17	Nonstate
931	Tungsten-molybdenum Mining	0.02	0.03	0.05	0	41	41	Non-SOE
932	Earth Metal Ores Mining	0.1	0.13	0.00	0	14	14	Nonstate
933	Radioactive Metal Ore Mining	0.14	0.92	0.00	99	0	99	SOE-Central
939	Other Rare Metal Ore Mining	0.04	0.04	0.00	6	29	35	Non-SOE

1011	Gypsum and Limestone Mining and Quarrying	0	0	0.06	0	9	9	Non-SOE
1012	Construction & Decoration Stone Mining and Quarrying	0	0.01	0.06	0	7	7	Non-SOE
1013	Fireclay and Dolomite Mining and Quarrying	0.01	0.01	0.03	0	8	8	Non-SOE
1019	Clay and Other Stone Mining and Quarrying	0	0	0.13	2	9	11	Non-SOE
1020	Chemical Mineral Mining	0.02	0.04	0.04	1	39	39	Non-SOE
1030	Salt Mining	0.02	0.03	0.05	4	57	61	Local SOE
1091	Asbestos and Mica Ore Mining	0.16	0.16	0.00	5	49	54	SOE-Local
1092	Graphite and Talc Mining	0.02	0.02	0.02	0	11	11	Non-SOE
1093	Gem Stone Mining	0.45	0.6	0.00	0	0	0	Nonstate
1099	Other Non-metallic Mineral Mining	0.01	0.01	0.04	1	4	6	Non-SOE
1100	Other Ore Mining	0.12	0.12	0.00	0	3	3	Nonstate
1310	Corn Milling	0	0	0.85	0	12	12	Non-SOE
1320	Feed Processing	0	0	0.81	1	2	3	Non-SOE
1331	Edible Vegetable Oil Processing	0.01	0.01	0.90	3	9	12	Non-SOE
1332	Non-Edible Vegetable Oil Processing	0.02	0.02	0.01	0	15	15	Non-SOE
1340	Sugar	0.01	0.03	0.11	1	20	22	Non-SOE
1351	Livestock Slaughtering	0	0	0.62	0	8	8	Non-SOE
1352	Meat and the Side-Products Processing	0.03	0.03	0.47	0	4	4	Non-SOE
1361	Seafood Frozen Processing	0	0	0.40	1	3	4	Non-SOE
1362	Fish Meat Paste Products and Seafood Dried & Preserved Processing	0.01	0.01	0.06	0	1	1	Non-SOE
1363	Seafood Feed	0.02	0.02	0.02	0	0	0	Non-SOE
1364	Fish Oil Distilling and Products	0.24	0.24	0.00	0	0	0	Nonstate
1369	Other Seafood Processing	0.02	0.02	0.02	0	1	1	Non-SOE
1370	Vegetable Fruit & Nut Processing	0	0	0.38	0	2	2	Non-SOE
1391	Starch and Starch Products	0.04	0.04	0.29	0	6	6	Non-SOE
1392	Bean Products	0.02	0.02	0.04	0	5	6	Non-SOE

1393	Egg Products Processing	0.01	0.01	0.02	0	2	2	Non-SOE
1399	Other Not Listed Agricultural and Side-Product Processing	0	0	0.10	1	5	5	Non-SOE
1411	Bakeries & Bread	0.01	0.01	0.06	1	4	5	Non-SOE
1419	Biscuit & Other Baked Food	0.01	0.01	0.12	0	1	1	Non-SOE
1421	Confectioneries & Chocolate	0.04	0.04	0.09	0	1	1	Non-SOE
1422	Candied Fruits	0.01	0.01	0.04	0	0	0	Non-SOE
1431	Rice and Flour Products	0.01	0.01	0.08	0	6	6	Non-SOE
1432	Frozen Food	0.05	0.05	0.06	0	2	2	Non-SOE
1439	Instant Noodle and Other Instant Food	0.02	0.02	0.14	1	2	3	Non-SOE
1440	Liquid Dairy and Dairy Products	0.01	0.03	0.30	1	32	32	Non-SOE
1451	Canned Meat & Poultry	0.04	0.04	0.01	0	27	27	Non-SOE
1452	Canned Seafood	0.06	0.06	0.01	0	21	21	Non-SOE
1453	Canned Vegetable and Fruit	0.01	0.01	0.09	10	14	24	Non-SOE
1459	Other Canned Food	0.06	0.06	0.01	0	5	5	Non-SOE
1461	Monosodium Glutamate	0.11	0.11	0.07	0	28	28	Nonstate
1462	Soy Sauce, Edible Vinegar and Similarity Product	0.03	0.03	0.07	0	17	17	Non-SOE
1469	Other Spice and Seasoning & Fermented Products	0.01	0.01	0.09	0	9	9	Non-SOE
1491	Nutritious and Health Food	0.04	0.04	0.08	0	2	2	Non-SOE
1492	Frozen Beverage and Edible Ice	0.01	0.01	0.04	0	6	6	Non-SOE
1493	Salt Processing	0.03	0.07	0.01	30	42	72	Local SOE
1494	Food and Feed Additive	0.01	0.01	0.23	0	2	2	Non-SOE
1499	Other Not Listed Food	0.01	0.01	0.04	8	5	12	Non-SOE
1510	Alcohol	0.03	0.03	0.08	0	23	23	Non-SOE
1521	Distilled Spirit	0.04	0.06	0.40	1	53	53	Local SOE
1522	Beer	0.01	0.04	0.22	9	31	40	Non-SOE
1523	Cooking Wine	0.07	0.07	0.02	0	44	44	Non-SOE

1524	Wine	0.09	0.09	0.05	8	29	37	Non-SOE
1529	Other Drink	0.06	0.06	0.02	0	2	2	Non-SOE
1531	Carbonated Soft Drinks	0.03	0.04	0.11	0	6	6	Non-SOE
1532	Bottled and Canned Water	0.05	0.05	0.09	0	5	5	Non-SOE
1533	Fruit, Vegetable Juice and Syrup & Its Beverage	0.02	0.02	0.11	3	3	6	Non-SOE
1534	Beverage Including Dairy and Plant Protein Beverage	0.02	0.02	0.07	0	3	3	Non-SOE
1535	Solid Beverage	0.32	0.32	0.04	0	3	4	Nonstate
1539	Tea Beverage and Other Soft Beverage	0.03	0.04	0.09	0	0	0	Non-SOE
1540	Refined Tea Processing	0	0	0.09	0	3	3	Non-SOE
1610	Tobacco Leaf Processing	0.09	0.32	0.02	50	48	98	SOE-Central
1620	Cigarettes	0.04	0.84	0.89	92	8	100	SOE-Central
1690	Other Tobacco Products Processing	0.06	0.07	0.01	7	46	53	Local SOE
1711	Cotton and Chemical Fiber Spinning and Weaving Processing	0.01	0.01	1.83	1	7	8	Non-SOE
1712	Cotton and Chemical Fiber Dyeing Refined Processing	0	0	0.44	0	3	3	Non-SOE
1721	Wool Piece Processing	0.01	0.01	0.03	0	3	3	Non-SOE
1722	Wool Spinning	0.04	0.04	0.20	1	2	3	Non-SOE
1723	Wool Spinning Dyeing Refined Processing	0.04	0.04	0.04	0	0	0	Non-SOE
1730	Ramie, Linen and Hemp	0.01	0.01	0.04	0	11	11	Non-SOE
1741	Silk Reeling Processing	0.01	0.01	0.08	0	5	5	Non-SOE
1742	Thin Silk Spinning and Silk Processing	0.01	0.01	0.14	0	3	3	Non-SOE
1743	Silk Dyeing Refined Processing	0.02	0.02	0.02	0	1	1	Non-SOE
1751	Cotton and Chemical Product	0	0	0.31	0	2	2	Non-SOE
1752	Wool Product	0.02	0.02	0.03	0	2	2	Non-SOE
1753	Ramie Product	0.06	0.06	0.01	0	3	3	Non-SOE
1754	Silk Product	0.02	0.02	0.02	0	2	2	Non-SOE
1755	Rope, Cable and Thin Rope	0.01	0.01	0.03	0	3	3	Non-SOE

1756	Spinning and Weaving Thread and Towels and Washcloths	0.07	0.07	0.06	0	2	2	Non-SOE
1757	Nonwoven Fabric	0.01	0.01	0.09	1	4	4	Non-SOE
1759	Other Textile Product	0	0	0.08	0	5	5	Non-SOE
1761	Cotton, Chemical Fiber Knit Fabric, Knitting and Product	0	0	0.43	0	3	3	Non-SOE
1762	Wool Knit Fabric and Knitting Product	0	0	0.20	0	2	2	Non-SOE
1763	Silk Knit Fabric and Knitting Product	0.01	0.01	0.04	0	1	1	Non-SOE
1769	Other Knit Fabric and Knitting Product	0.01	0.01	0.04	3	2	5	Non-SOE
1810	Apparel	0	0	1.76	1	2	3	Non-SOE
1820	Textile Shoes	0.01	0.01	0.07	2	1	2	Non-SOE
1830	Hat, Cap, and Millinery	0.01	0.01	0.03	0	0	0	Non-SOE
1910	Leather Accessories and Trimmings	0.01	0.01	0.19	0	0	0	Non-SOE
1921	Leather Shoes	0	0	0.52	1	0	1	Non-SOE
1922	Leather Costume	0.01	0.01	0.07	0	0	0	Non-SOE
1923	Leather Luggage and Bags	0	0	0.16	0	3	3	Non-SOE
1924	Leather Glove and Ornament Products	0.01	0.01	0.03	0	0	0	Non-SOE
1929	Other Leather Product	0.03	0.03	0.04	0	20	20	Non-SOE
1931	Fur, Leather Accessories and Trimmings Processing	0.04	0.04	0.03	0	0	0	Non-SOE
1932	Fur Leather Apparel Processing	0.03	0.03	0.02	8	2	10	Non-SOE
1939	Other Fur Leather Product Processing	0.01	0.02	0.02	0	0	0	Non-SOE
1941	Feather, Down Processing	0.02	0.02	0.03	0	0	0	Non-SOE
1942	Feather, Down Products Processing	0.01	0.01	0.05	0	0	0	Non-SOE
2011	Sawmills	0.01	0.01	0.07	1	8	9	Non-SOE
2012	Wood Chips Processing	0	0	0.05	0	3	3	Non-SOE
2021	Plywood	0	0	0.34	0	2	2	Non-SOE
2022	Fiberboard	0.03	0.03	0.13	0	12	12	Non-SOE
2023	Shaving Board	0.03	0.03	0.04	0	23	23	Non-SOE

2029	Other Man-Made Woodboard	0.01	0.01	0.14	0	1	1	Non-SOE
2031	Construction Wood and Wood Sets Processing	0	0	0.12	0	5	5	Non-SOE
2032	Wood Containers	0.01	0.01	0.02	0	0	0	Non-SOE
2039	Soft Wood Products and Other Wood Products	0	0	0.06	0	3	3	Non-SOE
2040	Bamboo, Vine, Palm and Grass Products	0	0	0.07	0	3	3	Non-SOE
2110	Wood Furniture	0	0	0.35	0	1	1	Non-SOE
2120	Bamboo, Vine Furniture	0.03	0.03	0.01	0	1	1	Non-SOE
2130	Metal Furniture	0	0	0.14	0	3	3	Non-SOE
2140	Plastic Furniture	0.03	0.03	0.01	0	0	0	Non-SOE
2190	All Other Furniture	0.01	0.01	0.10	0	0	0	Non-SOE
2210	Pulp	0.06	0.06	0.05	0	32	32	Non-SOE
2221	Machine Made Paper and Paperboard	0.01	0.01	0.76	2	22	24	Non-SOE
2222	Handmade Paper	0.08	0.08	0.00	0	23	23	Non-SOE
2223	Processed Paper	0.01	0.01	0.07	0	4	4	Non-SOE
2231	Paper and Paper Board Container	0	0	0.39	0	2	2	Non-SOE
2239	Other Paper Products	0	0	0.20	0	1	1	Non-SOE
2311	Books, Magazines and Periodicals Printing	0	0.01	0.12	7	31	38	Non-SOE
2312	Notebook and Tablet	0.01	0.01	0.03	1	6	7	Non-SOE
2319	Lithographic Printing	0	0	0.35	6	8	14	Non-SOE
2320	Other Related Printing Activities	0.04	0.04	0.02	20	6	26	Non-SOE
2330	Recording Media Reproducing	0.04	0.04	0.01	8	11	18	Non-SOE
2411	Stationery	0.01	0.01	0.03	0	0	0	Non-SOE
2412	Pen and Pencil	0.02	0.02	0.03	0	4	4	Non-SOE
2413	Teaching Specimen and Mode	0.15	0.15	0.01	0	2	2	Nonstate
2414	Ink	0.11	0.11	0.00	0	6	6	Nonstate
2419	Other Stationery and Office Supplies	0.04	0.04	0.01	0	0	0	Non-SOE

2421	Ball	0.01	0.01	0.02	0	11	11	Non-SOE
2422	Athletic Equipment	0.03	0.03	0.04	0	4	4	Non-SOE
2423	Fitness Training Equipment	0.01	0.01	0.04	0	1	1	Non-SOE
2424	Sports Protection Appliances	0.02	0.02	0.01	0	0	0	Non-SOE
2429	Other Sporting and Athletic Goods	0.02	0.02	0.03	0	2	2	Non-SOE
2431	Chinese Musical Instrument	0.05	0.05	0.00	0	0	0	Non-SOE
2432	Western Musical Instrument	0.02	0.03	0.02	0	22	22	Non-SOE
2433	Electronic Musical Instrument	0.09	0.09	0.01	0	0	0	Non-SOE
2439	Other Musical Instrument and Recreational Goods	0.04	0.04	0.01	0	0	0	Non-SOE
2440	Toy	0.01	0.01	0.20	0	0	0	Non-SOE
2451	Outdoor Amusement Equipment	0.05	0.05	0.01	1	0	1	Non-SOE
2452	Entertaining Appliances and Indoor Amusement Equipment	0.11	0.11	0.01	0	0	0	Nonstate
2511	Crude Oil Processing and Petroleum Product	0.02	0.52	3.29	62	20	82	SOE-Central
2512	Man-Made Crude Oil Production Industry	0.09	0.09	0.01	0	0	0	Non-SOE
2520	Coke Smelting	0	0.01	0.68	4	15	19	Non-SOE
2611	Inorganic Acid	0.01	0.01	0.08	1	8	9	Non-SOE
2612	Alkali	0.02	0.04	0.18	3	61	64	Local SOE
2613	Inorganic Salt	0	0	0.21	2	19	22	Non-SOE
2614	Organic Chemical Material	0.02	0.07	1.03	26	23	49	Non-SOE
2619	Other Basic Chemical Raw Material	0.01	0.01	0.26	8	16	25	Non-SOE
2621	Nitrogenous Fertilizer	0.01	0.03	0.34	14	50	65	Local SOE
2622	Phosphate Fertilizer	0.07	0.12	0.08	0	68	68	SOE-Local
2623	Kalium Fertilizer	0.14	0.23	0.03	20	53	72	SOE-Local
2624	Compound Fertilizer	0.01	0.02	0.36	3	37	40	Non-SOE
2625	Organic and Micro Biological Fertilizer	0.02	0.02	0.04	0	4	4	Non-SOE
2629	Other Chemical Fertilizer	0.03	0.03	0.01	3	16	19	Non-SOE

2631	Chemical Pesticide	0.01	0.01	0.21	5	22	28	Non-SOE
2632	Biochemical and Micro Biological Pesticide	0.02	0.02	0.03	0	2	2	Non-SOE
2641	Coating	0	0	0.34	0	5	5	Non-SOE
2642	Printing ink	0.01	0.01	0.04	0	4	4	Non-SOE
2643	Dye	0.01	0.01	0.07	4	7	11	Non-SOE
2644	Dyestuff	0.03	0.03	0.10	0	4	4	Non-SOE
2645	Sealing Fillers and Similarities	0.02	0.02	0.03	1	1	2	Non-SOE
2651	Basic Plastics and Synthetic Resin	0.01	0.02	0.71	12	15	27	Non-SOE
2652	Synthetic Rubber	0.09	0.09	0.08	11	6	17	Non-SOE
2653	Synthon Single (Polymerization)	0.06	0.08	0.25	19	33	52	Local SOE
2659	Other Synthesized Material	0.03	0.03	0.05	4	3	7	Non-SOE
2661	Chemical Reagent and Aid Dose	0	0.01	0.65	2	6	8	Non-SOE
2662	Special Chemical Product	0.01	0.01	0.60	7	4	12	Non-SOE
2663	Forestry Chemical Products	0.01	0.01	0.05	0	10	10	Non-SOE
2664	Explosives and Fire and Flame Products	0	0.02	0.17	29	22	52	Central SOE
2665	Information Chemistry Product	0.02	0.02	0.12	13	12	25	Non-SOE
2666	Special Medicament Material For Environment Pollution Treatment	0.02	0.02	0.01	2	9	12	Non-SOE
2667	Animal Glue	0.02	0.02	0.01	0	6	6	Non-SOE
2669	Other Special Chemical Products	0.01	0.01	0.10	0	5	6	Non-SOE
2671	Soap, Washing Powder and Synthetic Detergent	0.12	0.12	0.19	0	8	8	Nonstate
2672	Cosmetics	0.05	0.05	0.10	0	7	7	Non-SOE
2673	Oral Cavity Sanitary Products	0.14	0.14	0.02	0	57	57	SOE-Local
2674	Spice and Essence	0.01	0.01	0.06	0	3	3	Non-SOE
2679	Other Daily Use Chemical Product	0.02	0.02	0.05	0	5	5	Non-SOE
2710	Chemical Medicines and Reagents	0.01	0.01	0.36	1	27	28	Non-SOE
2720	Pharmaceutical Preparations	0.01	0.01	0.53	1	25	26	Non-SOE

2730	Chinese Traditional Medicine Pills	0.01	0.01	0.09	1	9	10	Non-SOE
2740	Chinese Patent Drug	0.01	0.01	0.36	3	21	24	Non-SOE
2750	Veterinary Medicines	0.01	0.01	0.08	6	4	10	Non-SOE
2760	Biology Product Industry	0.01	0.01	0.17	10	8	18	Non-SOE
2770	Medical Material and Supplies	0.03	0.03	0.10	0	4	4	Non-SOE
2811	Chemical Fiber Plasm	0.07	0.07	0.03	0	14	14	Non-SOE
2812	Man-made Fiber (Fibrin Fiber)	0.04	0.05	0.07	2	55	56	Local SOE
2821	Polyamide Fiber	0.03	0.03	0.06	0	3	4	Non-SOE
2822	Polyester Fiber	0.02	0.02	0.44	2	3	5	Non-SOE
2823	Acrylic Fiber	0.2	0.2	0.01	51	0	51	SOE-Central
2824	Polyvinyl Alcohol Fiber	0.38	0.44	0.01	0	97	97	SOE-Local
2829	Other Synthon	0.01	0.02	0.09	1	1	2	Non-SOE
2911	Automobile, Airplane and Engineering Machinery Tyre	0.02	0.02	0.42	5	20	26	Non-SOE
2912	Strength Tyre	0.03	0.03	0.02	0	19	19	Non-SOE
2913	Tires Retreading	0.03	0.03	0.01	0	0	0	Non-SOE
2920	Balata Board, Hose, Belt	0	0	0.11	1	5	6	Non-SOE
2930	Balata Parts Product Industry	0.01	0.01	0.08	1	5	6	Non-SOE
2940	Rebirth Parts Product Industry	0.03	0.03	0.03	0	0	0	Non-SOE
2950	Daily Balata Product Industry	0.02	0.02	0.04	6	7	13	Non-SOE
2960	Balata Shoe	0.01	0.01	0.09	5	4	9	Non-SOE
2990	Other Balata Product Industry	0.01	0.01	0.07	2	1	3	Non-SOE
3010	Plastic Pellicle	0.01	0.01	0.26	1	9	10	Non-SOE
3020	Plastic Board Duct Mallet Material	0	0	0.43	0	8	9	Non-SOE
3030	Plastic Silk, Rope and Intertexture Product	0	0	0.22	0	3	3	Non-SOE
3040	Foam Plastics	0	0	0.09	0	4	4	Non-SOE
3050	Man-Made and Synthetic Leather	0.01	0.01	0.10	0	0	0	Non-SOE

3060	Plastic Packing Case and Container	0	0	0.18	2	2	4	Non-SOE
3070	Plastic Parts	0	0	0.17	1	2	2	Non-SOE
3081	Plastic Shoes	0.01	0.01	0.06	0	0	0	Non-SOE
3082	Daily Plastic Sundry Goods	0	0	0.17	0	1	2	Non-SOE
3090	Other Plastic Product Industry	0	0	0.27	0	3	3	Non-SOE
3111	Cement	0	0	1.05	5	29	34	Non-SOE
3112	Lime and Gypsum	0.01	0.01	0.05	0	5	5	Non-SOE
3121	Cement Product Industry	0	0	0.46	3	9	13	Non-SOE
3122	Rubstone Mechanism Component	0.01	0.01	0.09	5	8	14	Non-SOE
3123	Asbestine Cement Product Industry	0.07	0.07	0.03	3	0	3	Non-SOE
3124	Light Construction Material	0.01	0.01	0.07	15	20	35	Non-SOE
3129	Other Cement Product Industry	0.01	0.01	0.02	3	11	14	Non-SOE
3131	Tile	0	0	0.22	1	8	10	Non-SOE
3132	Construction and Hygienic Ceramics	0	0	0.36	0	0	0	Non-SOE
3133	Construction Stone	0	0	0.25	0	1	2	Non-SOE
3134	Waterproof Sealing Construction Materials	0.01	0.01	0.07	2	5	7	Non-SOE
3135	Heat Preservation and Sound-Proof Materials	0.01	0.01	0.04	0	14	14	Non-SOE
3139	Other Tile, Lime and Light Construction Material	0.01	0.01	0.07	2	5	7	Non-SOE
3141	Flat Glass Products	0.02	0.02	0.10	1	16	16	Non-SOE
3142	Industrial Technique Glass	0.01	0.01	0.15	0	3	3	Non-SOE
3143	Optical Glass	0.03	0.03	0.03	18	4	23	Non-SOE
3144	Glass Instruments	0.07	0.07	0.03	0	4	4	Non-SOE
3145	Daily Glass Product Industry	0	0	0.14	0	6	6	Non-SOE
3146	Glass Heat Preservation Vessel	0.07	0.07	0.01	0	2	2	Non-SOE
3147	Fiberglass and Allied Products	0.01	0.01	0.12	1	39	40	Non-SOE
3148	Glass Fiber Reinforced Plastic Product	0.01	0.02	0.07	12	4	16	Non-SOE

3149	Other Glass and Glass Product Industry	0.01	0.01	0.03	0	4	4	Non-SOE
3151	Construction and Hygienic Ceramics	0.01	0.01	0.05	0	3	3	Non-SOE
3152	Industrial Ceramics	0.01	0.01	0.09	4	4	8	Non-SOE
3153	Daily Ceramic	0	0	0.10	0	13	13	Non-SOE
3159	Other Ceramic Product Industry	0.01	0.01	0.02	0	1	1	Non-SOE
3161	Asbestine Product Industry	0.02	0.02	0.02	2	5	7	Non-SOE
3162	Mica Product Industry	0.11	0.11	0.01	0	22	22	Nonstate
3169	Other Fireproof Materials Products	0	0	0.35	1	6	7	Non-SOE
3191	Black Lead and Carbon Product	0	0.01	0.16	7	8	15	Non-SOE
3199	Other Non-metal Mineral Product	0.01	0.01	0.19	2	10	12	Non-SOE
3210	Metal Smelting	0.02	0.02	0.42	8	29	37	Non-SOE
3220	Steel Smelting	0.05	0.07	1.42	22	50	73	Local SOE
3230	Steel Rolling Processing	0.01	0.02	5.74	18	43	61	Local SOE
3240	Iron Alloy Smelting Industry	0	0.01	0.42	4	9	13	Non-SOE
3311	Copper Smelting	0.08	0.08	0.52	5	75	80	Local SOE
3312	Lead Zinc Smelting Industry	0.02	0.03	0.26	9	38	47	Non-SOE
3313	Nickel Cobalt Smelting	0.54	0.54	0.16	0	78	78	SOE-Local
3314	Tin Smelting Industry	0.2	0.21	0.04	0	85	85	SOE-Local
3315	Stibium smelting Industry	0.05	0.07	0.01	32	15	47	Non-SOE
3316	Aluminum Smelting	0.04	0.06	0.48	19	39	58	Local SOE
3317	Magnesium Smelting	0.02	0.02	0.03	0	0	0	Non-SOE
3319	Other Commonly Used Non-Ferrous Metal Smelting Industry	0.02	0.02	0.05	1	19	21	Non-SOE
3321	Gold Smelting	0.08	0.11	0.15	5	65	70	SOE-Local
3322	Silver Smelting	0.03	0.04	0.04	0	4	4	Non-SOE
3329	Other Valued Metal Smelting	0.07	0.07	0.01	0	1	1	Non-SOE
3331	G78 Smelting	0.07	0.08	0.08	0	83	83	Local SOE

3332	Rare Earth Metal Smelting	0.02	0.02	0.05	1	32	33	Non-SOE
3339	Other Rare Metal Smelting	0.04	0.04	0.04	3	33	37	Non-SOE
3340	Non-Ferrous Metaling Alloy	0.01	0.01	0.15	4	21	24	Non-SOE
3351	Commonly Used Non-Ferrous Rolling Processing	0	0.01	1.61	8	9	16	Non-SOE
3352	Valued Metal Rolling Processing	0.16	0.18	0.12	1	15	16	Nonstate
3353	Rare Earth Metal Rolling Processing	0.04	0.04	0.05	1	17	19	Non-SOE
3411	Metal Fabric	0	0	0.78	3	7	10	Non-SOE
3412	Metal Door and Window	0.01	0.01	0.18	2	1	2	Non-SOE
3421	Cutting tool	0.04	0.04	0.07	2	14	17	Non-SOE
3422	Handwork Tool	0.01	0.01	0.05	0	2	2	Non-SOE
3423	Farming or Gardening Metal Tool	0.02	0.02	0.02	0	1	1	Non-SOE
3424	Scissors and Knives Daily Metal Tool	0.01	0.01	0.03	0	5	5	Non-SOE
3429	Other Metal Tool	0.01	0.01	0.06	0	1	2	Non-SOE
3431	Container	0.05	0.05	0.03	5	10	15	Non-SOE
3432	Metal Pressing Vessels	0.01	0.01	0.08	3	11	15	Non-SOE
3433	Metal Packaging Vessels	0.01	0.01	0.12	0	7	7	Non-SOE
3440	Metal Thread Products	0.01	0.02	0.28	3	15	18	Non-SOE
3451	Construction, Household Use Metal Parts	0	0	0.12	0	1	1	Non-SOE
3452	Construction, Decoration and Plumbing Parts	0.01	0.01	0.16	1	9	10	Non-SOE
3453	Safety, Fire Protection Metal Products	0.01	0.01	0.02	0	1	1	Non-SOE
3459	Other Construction, Safety Metal Products	0.04	0.04	0.03	0	2	2	Non-SOE
3460	Metal Surface Treating and Heating Processing	0.01	0.01	0.23	1	5	7	Non-SOE
3471	Industrial Use Enamel Products	0.11	0.11	0.01	10	0	10	Nonstate
3472	Enamel Sanitary Ware	0.1	0.1	0.01	0	0	0	Non-SOE
3479	Enamel Commodity and Other Enamel Products	0.06	0.06	0.01	0	1	1	Non-SOE
3481	Metal Kitchen and Sanitary Ware Products	0.06	0.06	0.07	0	1	2	Non-SOE

3482	Metal Kitchen Utensils and Tablewares	0	0	0.13	0	1	1	Non-SOE
3489	Other Daily Metal Products	0	0	0.11	1	2	3	Non-SOE
3491	Coin and Other Valued Metal Lab Products	0.26	0.94	0.01	98	0	98	SOE-Central
3499	Other not listed Metal Products	0	0.01	0.26	1	8	9	Non-SOE
3511	Boiler and Other Fitting Manufacturing	0.03	0.07	0.19	33	14	47	Non-SOE
3512	Internal Combustion and Fitting	0.01	0.06	0.17	28	27	55	Central SOE
3513	Steam Turbine and Fitting	0.15	0.29	0.09	63	25	88	SOE-Central
3514	Water Turbine and Fitting	0.14	0.14	0.01	0	22	22	Nonstate
3519	Other Motor Machine	0.34	0.34	0.02	1	11	12	Nonstate
3521	Metal Cutting Machine Tool	0.03	0.09	0.18	1	58	59	Local SOE
3522	Metal Forming Machine Tool	0	0.01	0.05	0	13	13	Non-SOE
3523	Foundry Machinery	0.01	0.01	0.06	0	3	3	Non-SOE
3524	Metal Cutting and Welding Equipment	0.01	0.01	0.04	0	3	4	Non-SOE
3525	Machine Tool Parts	0.01	0.01	0.03	1	10	11	Non-SOE
3529	Other Metal Processing Machinery	0.01	0.01	0.08	2	5	7	Non-SOE
3530	Crane Transportation Equipment	0.02	0.03	0.58	3	37	40	Non-SOE
3541	Pump and Vacuum Equipment	0	0	0.19	5	11	16	Non-SOE
3542	Gas Compressor Machinery	0.02	0.02	0.13	1	19	19	Non-SOE
3543	Valve and Plug	0	0	0.24	3	2	5	Non-SOE
3544	Hydraulic Pressure unit and Pneumatic Machine and Component	0	0.01	0.20	1	11	12	Non-SOE
3551	Bearing	0.01	0.01	0.23	4	13	17	Non-SOE
3552	Gears and Other Conveyor and Conveying Equipment	0.01	0.01	0.16	6	6	12	Non-SOE
3560	Oven and Smelting Furnace	0.02	0.02	0.03	7	5	12	Non-SOE
3571	Fan Equipment	0.03	0.03	0.09	3	43	46	Non-SOE
3572	Gas, Liquid Separation and Purifying Equipment	0.01	0.01	0.08	0	18	18	Non-SOE
3573	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment	0.01	0.02	0.26	0	13	14	Non-SOE

3574	Pneumatic and Power-Driven Tool	0.02	0.02	0.09	0	1	1	Non-SOE
3575	Gunjet Type Products	0.03	0.03	0.01	4	1	5	Non-SOE
3576	Packaging Equipment	0.02	0.02	0.03	4	9	13	Non-SOE
3577	Scale and Balance Equipment	0.02	0.05	0.02	0	5	6	Non-SOE
3579	Other General Equipment	0.01	0.01	0.12	10	12	22	Non-SOE
3581	Metal Airproof Parts	0.01	0.01	0.09	2	2	4	Non-SOE
3582	Fastening Units and Springs	0	0	0.16	1	4	5	Non-SOE
3583	Machine Parts Processing and Maintenance	0	0	0.21	10	7	17	Non-SOE
3589	Other General Parts	0.02	0.02	0.09	0	5	5	Non-SOE
3591	Steel and Iron Forging	0	0	0.64	3	10	12	Non-SOE
3592	Forging Unit and Powder Metallurgy Products	0	0	0.31	5	5	10	Non-SOE
3611	Mining Equipment	0.02	0.03	0.29	18	41	59	Local SOE
3612	Special Oil Mining Equipment	0.02	0.03	0.20	16	20	36	Non-SOE
3613	Building Construction Equipment	0.03	0.04	0.41	3	37	40	Non-SOE
3614	Building Material Producing Equipment	0.01	0.03	0.08	23	12	35	Non-SOE
3615	Special Metallurgy Equipment	0.06	0.16	0.17	39	38	77	SOE-Central
3621	Petroleum Producing, Chemical Producing Special Equipment	0.01	0.01	0.08	6	24	30	Non-SOE
3622	Rubber Processing Special Equipment	0.03	0.06	0.02	22	15	37	Non-SOE
3623	Plastic Processing Special Equipment	0.03	0.03	0.05	1	0	1	Non-SOE
3624	Sawmill and Woodworking Machinery	0.01	0.01	0.02	0	9	9	Non-SOE
3625	Die	0	0	0.23	0	3	3	Non-SOE
3629	Other Non-Metal Process Special Equipment	0.03	0.03	0.01	0	19	19	Non-SOE
3631	Food, Beverage, Tobacco Industrial Special Use Equipment	0.01	0.03	0.05	21	12	33	Non-SOE
3632	Agricultural and Sideline Products Processing Equipment	0.02	0.02	0.05	0	3	3	Non-SOE
3633	Animal Feeds Equipment	0.06	0.06	0.01	0	17	17	Non-SOE
3641	Plasm Making and Paper Industry Machinery	0.01	0.01	0.04	1	6	8	Non-SOE

3642	Printing Industrial Equipment	0.01	0.01	0.03	2	24	26	Non-SOE
3643	Household Chemicals Producing Equipment	0.04	0.04	0.00	0	0	0	Non-SOE
3644	Pharm Producing Equipment	0.02	0.02	0.01	0	8	8	Non-SOE
3645	Lighting Apparatus and Fixture Special Equipment	0.02	0.02	0.01	0	1	1	Non-SOE
3646	Glass, Ceramics and Enamel Products Producing Equipment	0.06	0.06	0.02	0	17	17	Non-SOE
3649	Other Household Product Producing Equipment	0.06	0.06	0.01	2	1	2	Non-SOE
3651	Weaving Equipment	0.01	0.01	0.12	19	9	28	Non-SOE
3652	Leather and Fur Processing Equipment	0.08	0.08	0.00	0	0	0	Non-SOE
3653	Sewing Machinery	0.02	0.02	0.04	0	19	19	Non-SOE
3659	Other Apparel Processing Equipment	0.09	0.09	0.01	0	9	9	Non-SOE
3661	Electrical Equipment	0.01	0.02	0.04	12	9	21	Non-SOE
3662	Electric Industrial Equipment	0.01	0.01	0.09	1	11	12	Non-SOE
3669	Aviation, Aerospace and Other Special Equipment	0.08	0.38	0.01	69	12	82	SOE-Central
3671	Tractor	0.12	0.12	0.07	40	13	53	SOE-Central
3672	Mechanical Farming Machinery and Equipment	0.04	0.04	0.08	1	10	11	Non-SOE
3673	Forestry Mechanical Equipment	0.16	0.16	0.00	0	17	17	Nonstate
3674	Husbandry Mechanical Equipment	0.15	0.15	0.00	0	3	3	Nonstate
3675	Fishing Mechanical Equipment	0.09	0.09	0.00	0	3	3	Non-SOE
3676	Agriculture Machinery Parts	0.01	0.01	0.06	0	0	0	Non-SOE
3679	Other Agriculture Machinery and Maintenance	0.31	0.31	0.08	8	40	48	Nonstate
3681	Diagnosis, Monitoring and Treatment Equipment	0.03	0.03	0.05	0	11	11	Non-SOE
3682	Dental Equipment and Other Utensils	0.05	0.05	0.00	0	2	2	Non-SOE
3683	Lab and Disinfectant Equipment and Utensils	0.11	0.11	0.01	0	40	40	Nonstate
3684	Medical, Surgery and Veterinarian Tools	0.02	0.02	0.06	0	2	2	Non-SOE
3685	Mechanical Treatment and Nursing Equipment	0.03	0.03	0.01	3	9	12	Non-SOE
3686	Artificial Limb, Organ and Implantation Equipment	0.06	0.07	0.01	1	14	15	Non-SOE

3689	Other Medical Equipment and Supplies	0.01	0.01	0.03	5	0	5	Non-SOE
3691	Environmental Protection and Pollution Treatment Equipment	0.02	0.02	0.14	6	6	12	Non-SOE
3692	Geology Reconnaissance Special Equipment Manufacturing	0.11	0.13	0.01	17	40	57	SOE-Local
3693	Postal Industrial Equipment	0.2	0.2	0.00	53	16	69	SOE-Central
3694	Commercial, Food and Beverage, and Service Industry Machinery	0.06	0.06	0.00	0	0	0	Non-SOE
3695	Social Public Security Equipment and Supplies	0.02	0.02	0.04	1	3	4	Non-SOE
3696	Transportation Safety and Controlling Equipment	0.04	0.04	0.01	0	11	11	Non-SOE
3697	Water Resource Professional Equipment	0.02	0.02	0.01	8	4	12	Non-SOE
3699	Other Environmental Protection, Social Security Special Equipment	0.01	0.01	0.10	8	16	25	Non-SOE
3711	Locomotives and Trains	0.06	0.48	0.16	70	17	87	SOE-Central
3712	Mining Vehicles	0.07	0.07	0.00	0	7	7	Non-SOE
3713	Locomotives Parts	0.02	0.03	0.08	17	18	35	Non-SOE
3714	Rail Apparatus, Equipment and Parts	0.03	0.2	0.07	53	5	58	SOE-Central
3719	Other Rail Transportation Equipment and Repairing	0.05	0.65	0.03	89	2	91	SOE-Central
3721	Automobile Complete	0.03	0.13	2.87	33	55	88	SOE-Local
3722	Modified Motor Vehicle	0.01	0.02	0.26	13	19	32	Non-SOE
3723	Trolley	0.06	0.06	0.00	0	22	22	Non-SOE
3724	Automobile Body and Trailer	0.01	0.02	0.06	4	24	28	Non-SOE
3725	Automobile Parts and Attachments	0	0.01	2.23	4	12	16	Non-SOE
3726	Automobile Repairing Service	0.01	0.01	0.05	3	18	21	Non-SOE
3731	Motorcycle Complete	0.03	0.04	0.21	6	19	26	Non-SOE
3732	Motorcycle Parts and Attachments	0.01	0.01	0.18	1	7	8	Non-SOE
3741	Bicycle and Handicapped Vehicle	0.01	0.01	0.08	0	7	7	Non-SOE
3742	Moped	0.01	0.01	0.05	0	1	1	Non-SOE
3751	Metal Ship Building	0.01	0.1	0.70	43	8	51	Central SOE
3752	Non-metal Ship Building	0.12	0.12	0.01	3	1	4	Nonstate

3753	Pleasure Boats and Sport Boats and Repairing	0.06	0.06	0.00	0	2	2	Non-SOE
3754	Boat Auxiliary	0.01	0.05	0.11	31	11	41	Non-SOE
3755	Ship Repairing and Dismantling	0.07	0.17	0.11	53	18	72	SOE-Central
3759	Navigation Mark and Other Floating Equipment	0.61	0.88	0.01	0	98	98	SOE-Local
3761	Airplane and Repairing	0.04	0.67	0.21	91	2	93	SOE-Central
3762	Aircraft	0.11	0.94	0.01	99	1	99	SOE-Central
3769	Other Aircraft	0.15	0.15	0.00	0	0	0	Nonstate
3791	Diving and Underwater Succoring, Refloating Equipment	0.26	0.26	0.00	13	0	13	Nonstate
3792	Metal Sign and Facilities for Traffic Control	0.03	0.03	0.01	0	4	4	Non-SOE
3799	All Other Transportation Equipment	0.14	0.14	0.03	4	4	8	Nonstate
3911	Collector Rings for Generators	0.01	0.03	0.29	26	13	39	Non-SOE
3912	Motor	0.01	0.01	0.21	4	22	26	Non-SOE
3919	Tiny Motor and Others Motor	0.01	0.01	0.18	1	1	2	Non-SOE
3921	Transformers Rectifier, Electric Capacity	0.01	0.01	0.45	13	6	19	Non-SOE
3922	Capacitor and Other Attachments	0.01	0.02	0.04	0	2	3	Non-SOE
3923	Switchgear and Switchboard Apparatus	0.01	0.01	0.55	10	8	19	Non-SOE
3924	Electric and Electronic Component	0.01	0.01	0.19	1	4	5	Non-SOE
3929	Other Relay and Industrial Control	0.02	0.02	0.16	5	24	30	Non-SOE
3931	Wire and Cable Manufacturing	0	0	1.24	1	5	5	Non-SOE
3932	Optical Fiber and Cable	0.04	0.05	0.09	18	6	24	Non-SOE
3933	Insulated Products	0.02	0.02	0.07	2	3	4	Non-SOE
3939	Other Electrical Appliance	0.01	0.01	0.05	3	3	6	Non-SOE
3940	Battery	0.01	0.02	0.54	1	6	7	Non-SOE
3951	Household Refrigerator and Home Freezer	0.13	0.13	0.33	0	12	12	Nonstate
3952	Air Conditioner	0.18	0.2	0.43	0	36	36	Nonstate
3953	Fans, household-type electric,	0.03	0.03	0.06	0	0	0	Non-SOE

3954	Fans, household-type kitchen,	0.04	0.04	0.22	0	1	1	Non-SOE
3955	Household Vacuum Cleaner and Laundry Equipment	0.03	0.03	0.11	0	7	7	Non-SOE
3956	Appliance for Beauty Parlor and Health Manufacturing	0.04	0.04	0.03	0	0	0	Non-SOE
3957	Electrical Home Appliance and Device Parts	0.01	0.01	0.08	0	12	12	Non-SOE
3959	Other Electrical Appliance	0.01	0.01	0.08	0	0	0	Non-SOE
3961	Gas, Solar and Similar Energy Appliance	0.01	0.01	0.11	0	1	1	Non-SOE
3969	Other Non-Electric Home Appliance Manufacturing	0.05	0.05	0.01	0	0	0	Non-SOE
3971	Lighting Fixture	0.01	0.01	0.12	0	1	1	Non-SOE
3972	Lighting Equipment	0	0	0.18	0	1	1	Non-SOE
3979	Lamp Appliance Accessories and Other Lighting Equipment	0.01	0.01	0.06	0	11	11	Non-SOE
3991	Automotive Light Bulbs and Signal Equipment	0.04	0.04	0.05	0	12	12	Non-SOE
3999	All Other Electric Machinery	0.05	0.05	0.06	18	2	21	Non-SOE
4011	Transmission Equipment	0.02	0.05	0.12	33	18	51	Central SOE
4012	Switching Equipment	0.36	0.4	0.50	40	2	42	Nonstate
4013	Communications Terminal Equipment	0.05	0.05	0.09	7	10	17	Non-SOE
4014	Mobile Communications Equipment and Terminal Equipment	0.07	0.07	0.78	1	6	8	Non-SOE
4019	Other Communication Equipment	0.02	0.03	0.09	21	7	28	Non-SOE
4020	Radar Detectors and Auxiliary Apparatus	0.14	0.23	0.02	25	70	94	SOE-Local
4031	Television and Radio Transmission Equipment	0.06	0.08	0.01	3	29	33	Non-SOE
4032	Television and Radio Receiving equipment	0.02	0.02	0.05	2	4	6	Non-SOE
4039	Applied TV Equipment and Other Audio-Video Equipment	0.06	0.06	0.02	0	8	8	Non-SOE
4041	Computer Body	0.05	0.05	1.63	0	5	5	Non-SOE
4042	Computer Network Equipment Manufacturing	0.06	0.06	0.07	0	4	4	Non-SOE
4043	Computer Peripheral Equipment	0.02	0.02	1.13	2	4	5	Non-SOE
4051	Vacuum Tubes	0.05	0.06	0.07	4	59	64	Local SOE
4052	Semi-conductor Devices	0.02	0.02	0.10	0	11	11	Non-SOE

4053	Integrated Circuit	0.02	0.02	0.32	2	7	9	Non-SOE
4059	Photovoltaic devices	0.02	0.02	0.64	4	17	21	Non-SOE
4061	Electronic Components	0.01	0.01	1.12	1	11	12	Non-SOE
4062	Bare Printed Circuit Board	0.02	0.02	0.37	0	2	2	Non-SOE
4071	Household Video Equipment Manufacturing	0.04	0.04	0.56	4	39	43	Non-SOE
4072	Household Audio Equipment Manufacturing	0.02	0.02	0.17	0	2	2	Non-SOE
4090	Other Electronic Devices	0.01	0.02	0.21	1	12	12	Non-SOE
4111	Instruments for Industrial Automation Control	0.01	0.01	0.22	11	17	28	Non-SOE
4112	Electrical Instruments and Meters	0.01	0.01	0.03	7	5	12	Non-SOE
4113	Drawing, Counting and Gauge Device	0.01	0.01	0.02	0	17	17	Non-SOE
4114	Lab Instrument and Apparatus	0.03	0.03	0.02	2	9	11	Non-SOE
4115	Experimental Machinery	0.05	0.05	0.01	2	6	8	Non-SOE
4119	General Instrument, Meter Component Parts for Supply Manufacturing	0.05	0.05	0.08	1	3	4	Non-SOE
4121	Environment Monitor Meter and Instrument	0.05	0.05	0.01	0	5	5	Non-SOE
4122	Auto Instrument, and Other Meter	0.03	0.04	0.04	1	8	9	Non-SOE
4123	Navigational, Meteorological and Marine Apparatus Manufacturing	0.05	0.09	0.02	41	22	63	Central SOE
4124	Meter Apparatus for Farming, Forestry and Fishing	0.15	0.15	0.00	0	0	0	Nonstate
4125	Geologic Prospecting, Earthquakes use Instrument	0.1	0.13	0.01	47	3	49	Nonstate
4126	Teaching Apparatus	0.04	0.04	0.01	1	1	2	Non-SOE
4127	Nucleon and Nuclear Radiation Measuring Apparatus	0.09	0.12	0.00	50	13	64	SOE-Central
4128	Instrument for Measuring and Testing Electricity and Electrical Signals	0.03	0.03	0.03	14	5	19	Non-SOE
4129	Other Special Used Apparatus	0.05	0.06	0.02	22	8	29	Non-SOE
4130	Watch, Clock, and Counting Device	0.01	0.01	0.04	0	9	9	Non-SOE
4141	Optical Instrument	0.04	0.06	0.08	30	10	39	Non-SOE
4142	Glasses	0.01	0.01	0.03	0	0	0	Non-SOE
4151	Filming Machine	0.2	0.2	0.00	0	26	26	Nonstate

4152	Slide Projector and Overhead Projector	0.25	0.25	0.00	0	0	0	Nonstate
4153	Camera Equipment	0.08	0.08	0.10	0	0	0	Non-SOE
4154	Copy and Offset Machine	0.07	0.1	0.08	1	3	4	Non-SOE
4155	Electronic Calculator	0.07	0.07	0.04	0	15	15	Non-SOE
4159	Other Stationery and Office Machine	0.13	0.13	0.01	1	0	1	Nonstate
4190	Instrument, Meter and Repairing	0.02	0.02	0.01	1	6	7	Non-SOE
4211	Carving	0.01	0.01	0.05	0	1	1	Non-SOE
4212	Metal Handicraft	0.02	0.02	0.04	17	1	18	Non-SOE
4213	Lacquerware	0.03	0.03	0.01	0	0	0	Non-SOE
4214	Artificial Flower and Painting	0.02	0.02	0.02	0	0	0	Non-SOE
4215	Natural Fiber	0	0	0.05	0	0	0	Non-SOE
4216	Drawwork and Embroidery	0	0	0.07	0	0	0	Non-SOE
4217	Carpet and Arras	0.01	0.01	0.05	0	5	5	Non-SOE
4218	Jewellery and Silverware	0.02	0.03	0.19	0	7	7	Non-SOE
4219	Other Craft	0	0	0.11	0	2	2	Non-SOE
4221	Mirrors	0.03	0.03	0.01	0	0	0	Non-SOE
4222	Broom, Brush, and Mop	0.05	0.05	0.05	0	0	0	Non-SOE
4229	Other Various Household Supplies	0.01	0.01	0.10	0	0	0	Non-SOE
4230	Coal Product	0.02	0.02	0.01	0	13	13	Non-SOE
4290	All Other Non-listed Industry	0.01	0.07	0.07	45	9	54	Central SOE
4310	Metal Waste and fragment Treatment and Processing	0.02	0.02	0.23	17	5	22	Non-SOE
4320	Non-Metal Waste and fragment Treatment and Processing	0.01	0.01	0.03	2	7	9	Non-SOE
4411	Thermal Power Generation	0	0.22	1.88	46	37	83	SOE-Central
4412	Hydroelectric Power Generation	0.03	0.22	0.26	52	31	84	SOE-Central
4413	Nuclear Electric Power Generation	0.21	1	0.05	100	0	100	SOE-Central
4419	Other Power Industry	0.02	0.11	0.06	27	47	74	SOE-Local

4420	Transmission and Distribution of Electric Power	0.03	0.5	4.00	80	20	99	SOE-Central
4430	Heating Power Production and Supply	0.01	0.04	0.17	7	62	70	Local SOE
4500	Natural Gas Production and Distribution	0.02	0.03	0.35	1	67	68	Local SOE
4610	Tap Water Production and Supply	0	0.04	0.15	0	82	83	Local SOE
4620	Sewage Treatment and Regeneration	0.02	0.03	0.02	0	64	64	Local SOE
4690	Other Sewage Treatment, Utilizing and Distribution	0.36	0.36	0.01	0	1	1	Nonstate

English translation of four digit industry code from Beijing HL Consulting (2008)

Appendix B: Average fixed assets per worker, manufacturing sectors (2011)

	SOE Employees (000)	SOE Fixed Assets per Employee	Non-State Employees (000)	Non-SOE Fixed Assets / Employee	
Smelting and Pressing of Ferrous Metals	1,361.6	757,928.9	936.3	265,620.0	2.9
Manufacture of Paper and Paper Products	104.3	582,003.8	612.1	132,354.2	4.4
Manufacture of Raw Chemical Materials and Chemical Products	965.5	548,771.6	1,591.9	193,365.2	2.8
Smelting and Pressing of Non-ferrous Metals	650.2	503,165.2	589.9	201,346.0	2.5
Manufacture of Non-metallic Mineral Products	512.8	472,825.7	2,448.5	167,135.4	2.8
Manufacture of Chemical Fibers	73.9	317,158.3	172.7	226,155.2	1.4
Manufacture of Transport Equipment	1,883.6	287,962.4	1,505.9	129,643.4	2.2
Recycling and Disposal of Waste	5.5	280,909.1	73.2	226,051.9	1.2
Manufacture of Artwork and Other Manufacturing	69.6	263,448.3	453.6	70,244.7	3.8
Manufacture of Communication Equipment, Computers and Other Electronic Equipment	602.5	247,965.1	885.2	84,098.5	2.9
Manufacture of Plastics	66.2	235,921.5	1,001.7	112,392.9	2.1
Manufacture of Beverages	256.1	207,184.7	394.0	153,454.3	1.4
Processing of Food from Agricultural Products	179.6	203,786.2	1,745.9	149,454.7	1.4
Manufacture of Special Purpose Machinery	670.8	199,157.7	1,070.0	134,837.4	1.5
Manufacture of General Purpose Machinery	633.6	192,762.0	2,172.7	126,287.6	1.5
Manufacture of Rubber	107.9	192,103.8	311.6	145,346.6	1.3
Manufacture of Foods	132.9	186,772.0	666.9	132,513.1	1.4
Manufacture of Electrical Machinery and Equipment	400.7	184,042.9	1,859.3	114,298.9	1.6
Manufacture of Medicines	305.0	183,895.1	439.0	169,435.1	1.1
Manufacture of Metal Products	182.3	178,387.3	1,423.4	131,864.5	1.4
Processing of Timber, Manufacture of Wood, Bamboo, Rattan, Palm and Straw Products	53.5	132,691.6	836.5	98,932.5	1.3
Manufacture of Measuring Instruments and Machinery for Cultural Activity and Office Work	137.4	130,837.0	315.9	110,528.6	1.2
Manufacture of Furniture	11.5	128,521.7	476.3	80,886.0	1.6
Manufacture of Textile	252.1	118,072.2	2,729.4	105,060.1	1.1
Manufacture of Articles For Culture, Education and Sport Activities	11.7	83,931.6	247.5	62,189.9	1.3
Manufacture of Leather, Fur, Feather and Related Products	6.5	71,384.6	842.2	49,456.2	1.4
Manufacture of Textile Wearing Apparel, Footware and Caps	73.4	42,425.1	1,510.7	50,442.2	0.8
Printing, Reproduction of Recording Media			261.1	138,571.4	-

Note NBS, China Statistical Yearbook 2012. Fixed assets is the ‘Original Value of Fixed Assets’ less ‘Accumulated Depreciation’. Employees is the Average Annual Number of Employed Persons, including part-time workers.

Appendix C: Regression results – SOEs in top percentile of manufacturing firms by fixed assets, by subsector (2011–2013)

Dependent Variable			Log (Profit / Fixed Assets)		Log ((Profit + Depreciation) / Fixed Assets)		Log (Value Added / Fixed Assets)	
			Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
Constant			-2.28	0.00	-0.73	0.00	-0.22	0.00
SOE x	1310	Corn Milling	-0.86	0.17	0.46	0.28	0.44	0.27
SOE x	1320	Feed Processing	0.62	0.59	0.07	0.93	-0.14	0.85
SOE x	1331	Edible Vegetable Oil Processing	-0.37	0.31	0.27	0.28	0.25	0.28
SOE x	1340	Sugar Processing	0.18	0.76	-0.49	0.24	-0.22	0.57
SOE x	1351	Livestock Slaughter	-0.73	0.28	0.63	0.18	1.41	0.00
SOE x	1352	Poultry Slaughter	-1.06	0.12	0.13	0.79	0.78	0.07
SOE x	1353	Meat Products and Their Sideline Products Processing	1.21	0.28	-0.01	0.99	0.22	0.75
SOE x	1391	Starch, and Starch Products	-0.14	0.86	-0.40	0.48	-0.48	0.36
SOE x	1399	Other Unlisted Agricultural and Sideline Foods Processing	-1.46	0.34	-1.31	0.22	-1.95	0.05
SOE x	1440	Dairy Products	-0.41	0.44	0.43	0.23	0.66	0.05
SOE x	1469	Other Condiments and Fermented Products	-1.57	0.06	-1.29	0.02	-0.46	0.39
SOE x	1511	Alcohol	-2.92	0.00	-1.47	0.01	-1.30	0.01
SOE x	1512	Liquor	0.79	0.03	1.07	0.00	1.02	0.00
SOE x	1513	Beer	-1.42	0.00	0.02	0.96	0.45	0.13
SOE x	1711	Cotton Yarn Processing	-1.40	0.00	-0.60	0.01	-0.49	0.02
SOE x	1712	Cotton Processing	-2.30	0.04	-2.25	0.00	-2.21	0.00
SOE x	1761	Knitted or Crocheted Fabric Weaving	-0.10	0.89	-0.49	0.32	-0.18	0.69
SOE x	1783	Woven Belt and Curtain Cloth	-0.39	0.74	-0.94	0.25	-0.53	0.48

SOE x	2110	Wooden Furniture	-0.44	0.74	-0.79	0.39	-0.71	0.40
SOE x	2211	Wooden Bamboo Pulp Manufacturing	1.21	0.23	0.85	0.22	0.29	0.64
SOE x	2221	Machine-made Paper and Paperboard	-0.14	0.54	0.04	0.80	0.23	0.11
SOE x	2319	Printing of Packaging and Upholstering	1.32	0.01	0.58	0.09	0.77	0.02
SOE x	2520	Coking	-1.19	0.00	-0.88	0.00	-0.56	0.00
SOE x	2611	Inorganic Acid	-1.09	0.34	-1.25	0.11	-1.24	0.08
SOE x	2612	Inorganic Alkali	-1.24	0.00	-0.81	0.00	-0.56	0.00
SOE x	2613	Inorganic Salt	-0.99	0.03	-1.06	0.00	-0.33	0.25
SOE x	2614	Organic Chemical Materials	-0.24	0.15	-0.17	0.14	-0.05	0.66
SOE x	2619	Other Basic Chemical Materials	0.34	0.34	0.48	0.05	0.78	0.00
SOE x	2621	Nitrogenous Fertilizer	-0.25	0.23	-0.20	0.17	-0.01	0.95
SOE x	2622	Phosphoric Fertilizer	-0.22	0.79	0.40	0.48	0.13	0.80
SOE x	2623	Potassic Fertilizer	-0.48	0.52	-0.86	0.10	-0.59	0.22
SOE x	2624	Compound or Mixed Fertilizers	-0.30	0.38	-0.24	0.32	-0.10	0.64
SOE x	2631	Chemical Pesticides	0.04	0.91	0.34	0.25	0.37	0.17
SOE x	2651	Primary-form Plastic and Synthetic Resin	-0.22	0.28	-0.33	0.02	-0.17	0.18
SOE x	2652	Synthetic Rubber	-1.83	0.01	-1.45	0.00	-0.80	0.09
SOE x	2653	Synthetic Fibre (Single Polymer)	0.13	0.75	-0.07	0.81	-0.02	0.95
SOE x	2659	Other Synthetic Materials	-3.76	0.00	-2.20	0.00	-1.66	0.00
SOE x	2661	Chemical Reagent and Catalysts	-1.18	0.15	-0.93	0.10	-0.20	0.70
SOE x	2662	Chemical Products for Specific Purposes	-0.68	0.07	-0.46	0.07	0.08	0.74
SOE x	2664	Informational Chemical Products	-0.43	0.28	-0.23	0.40	-0.12	0.62
SOE x	2671	Explosives and Pyrotechnics Manufacturing	-1.94	0.00	-0.78	0.09	-0.36	0.40
SOE x	2710	Chemical Medicine Materials	-0.56	0.06	-0.38	0.06	-0.20	0.28
SOE x	2720	Chemical Medicine Dose	-1.35	0.00	-1.10	0.00	-0.98	0.00
SOE x	2740	Proprietary Chinese Medicines Production	-0.38	0.31	-0.19	0.45	0.15	0.52
SOE x	2760	Biopharmaceuticals Manufacturing	0.05	0.93	0.07	0.87	0.10	0.78
SOE x	2770	Sanitation Materials and Medical Articles	0.89	0.23	0.75	0.15	0.70	0.14
SOE x	2812	Man-made Fibre (Fibre Material)	0.31	0.35	-0.21	0.34	0.05	0.79

SOE x	2826	Spandex Fiber	-0.26	0.71	0.24	0.63	0.33	0.47
SOE x	2911	Tyre Production	-0.76	0.00	-0.49	0.00	-0.15	0.31
SOE x	2921	Plastic Film	-0.37	0.56	-0.42	0.34	-0.12	0.76
SOE x	2922	Plastic Board, Pipeline and Shaped Products	-1.10	0.03	-0.42	0.23	0.02	0.96
SOE x	3011	Cement	0.23	0.05	0.11	0.16	0.13	0.09
SOE x	3021	Cement Products	-0.56	0.44	0.04	0.94	0.39	0.40
SOE x	3041	Flat Glass	-1.19	0.04	-0.32	0.42	-0.08	0.83
SOE x	3052	Optical Glass	-0.20	0.78	-0.03	0.95	-0.21	0.64
SOE x	3061	Glass Fibre and Its Products	-0.61	0.16	0.03	0.91	0.22	0.43
SOE x	3072	Special Ceramics	-1.70	0.14	-2.13	0.01	-1.95	0.01
SOE x	3091	Graphite and Carbon Products	0.40	0.46	0.02	0.96	-0.10	0.78
SOE x	3110	Iron Smelting	-1.58	0.00	-0.57	0.05	-0.33	0.21
SOE x	3120	Steel Smelting	-1.12	0.00	-0.35	0.05	0.02	0.89
SOE x	3130	Ferrous Metal Casting	-1.47	0.01	-0.22	0.54	0.02	0.96
SOE x	3140	Steel Pressing	-1.20	0.00	-0.71	0.00	-0.43	0.00
SOE x	3150	Smelting of Ferroalloy	0.50	0.31	0.48	0.16	0.57	0.07
SOE x	3211	Copper Smelting	0.33	0.49	0.52	0.11	0.20	0.51
SOE x	3212	Lead & Zinc Smelting	-1.10	0.02	-0.82	0.01	-0.53	0.08
SOE x	3213	Nickel & Cobalt Smelting	-1.34	0.11	-0.90	0.12	-1.04	0.05
SOE x	3215	Antimony Smelting	3.85	0.01	0.87	0.41	1.55	0.11
SOE x	3216	Aluminium Smelting	-0.56	0.05	-0.56	0.00	-0.34	0.06
SOE x	3219	Smelting of Other Common-used Non-ferrous Metals	-3.58	0.00	-0.78	0.35	0.14	0.86
SOE x	3221		1.13	0.05	0.65	0.11	0.55	0.14
SOE x	3240	Non-ferrous Metal Alloy	0.62	0.31	0.06	0.89	-0.01	0.98
SOE x	3261	Copper Rolling Processing	-0.86	0.03	-0.87	0.00	-0.20	0.43
SOE x	3262	Aluminum Rolling Processing	-1.89	0.00	-1.16	0.00	-0.48	0.04
SOE x	3312	Metal Doors and Windows	-3.20	0.01	-1.34	0.10	-0.70	0.35
SOE x	3340	Metal Thread, Rope and Their Products	-1.38	0.04	-1.60	0.00	-0.92	0.03
SOE x	3399		-0.37	0.58	0.27	0.55	0.46	0.27

SOE x	3411	Boiler and Its Auxiliary Equipment	0.70	0.58	1.59	0.07	1.35	0.09
SOE x	3412	Internal Combustion Engines and Its Fittings	0.61	0.09	0.39	0.11	0.44	0.05
SOE x	3421	Metal-cutting Machine Tools	0.03	0.96	0.18	0.65	0.05	0.89
SOE x	3429	Other Metal-processing Machines	-1.41	0.11	-0.19	0.75	1.02	0.07
SOE x	3431	Light-small Lifting Equipment Manufacturing	1.38	0.24	1.72	0.03	1.16	0.12
SOE x	3432	Crane Manufacturing	-0.85	0.12	-0.38	0.31	-0.31	0.38
SOE x	3435	Elevators, Escalators and Lifts Manufacturing	-0.21	0.81	0.60	0.33	0.67	0.24
SOE x	3441	Pump and Vacuum Equipment	-1.15	0.25	-0.21	0.76	0.53	0.40
SOE x	3442	Gas Compressors	-0.33	0.52	-0.46	0.18	-0.38	0.23
SOE x	3451	Axletree	-0.87	0.16	-0.30	0.48	0.49	0.21
SOE x	3463	Gas- and Liquid-separating, and Purifying Equipment	-2.14	0.09	-1.67	0.05	-0.68	0.39
SOE x	3464	Freezing and Air-conditioning Equipment	0.26	0.68	0.44	0.30	0.40	0.31
SOE x	3484	Mechanical Parts Manufacture	-0.94	0.42	-1.07	0.18	-1.03	0.16
SOE x	3490	Other Ordinary Equipment	-1.59	0.02	-1.19	0.01	-0.53	0.20
SOE x	3511	Mining Machinery Manufacturing	-0.71	0.10	-0.55	0.07	-0.35	0.21
SOE x	3512	Petroleum Extraction Equipment	-0.77	0.13	-0.48	0.17	0.10	0.75
SOE x	3513	Machines of Construction Engineering	-0.70	0.08	-0.41	0.13	-0.40	0.11
SOE x	3514	Marine Engineering Equipment Manufacturing	0.02	0.98	0.31	0.47	0.39	0.33
SOE x	3515	Machinery of Producing Construction Materials	0.11	0.94	0.99	0.28	1.51	0.07
SOE x	3516	Metallurgical Equipment	0.36	0.75	0.28	0.72	0.76	0.28
SOE x	3546	Equipment for Glass, Ceramics and Porcelain Enamel Products Manufacture	-2.17	0.03	-2.03	0.00	-2.09	0.00
SOE x	3562	Equipment for Electronic Industry	-0.82	0.29	-0.27	0.61	-0.28	0.56
SOE x	3571	Tractor	-0.54	0.55	0.17	0.78	1.07	0.06
SOE x	3599	Other Special Equipment	1.55	0.06	1.52	0.01	1.20	0.02
SOE x	3610	Integrated Automobiles	-0.02	0.91	0.10	0.35	0.25	0.01
SOE x	3620	Refitted Automobiles	0.10	0.86	-0.21	0.60	0.02	0.95
SOE x	3660	Auto Parts and Fittings	0.01	0.95	0.05	0.70	0.24	0.06
SOE x	3713	Railway Engines Fittings	-1.73	0.00	-0.85	0.03	-0.30	0.39
SOE x	3731	Metal Ships	-0.61	0.00	-0.43	0.00	-0.30	0.02

SOE x	3734	Matching Equipment for Ships	-2.12	0.01	-0.84	0.14	-0.22	0.68
SOE x	3735	Ship Conversion and Demolition	1.85	0.03	0.93	0.10	0.66	0.21
SOE x	3741		-3.10	0.00	-1.25	0.00	-0.68	0.07
SOE x	3751	Integrated Motorcycle	-0.02	0.99	0.25	0.75	0.36	0.62
SOE x	3811	Dynamo and Dynamo Group	-1.27	0.00	-0.50	0.04	-0.01	0.98
SOE x	3812	Electromotor	0.47	0.60	0.49	0.43	0.91	0.11
SOE x	3821	Transformers, Rectifiers and Inductances	0.01	0.99	0.20	0.71	-0.09	0.86
SOE x	3823	Supply-electricity Switches Equipment	-0.80	0.19	-0.30	0.48	0.30	0.43
SOE x	3825	PV Equipment and Components Manufacturing	-0.80	0.08	-0.78	0.01	-1.02	0.00
SOE x	3829	Other Transmitting and Controlling Electricity Equipment	0.38	0.70	1.54	0.02	1.97	0.00
SOE x	3831	Wires and Cables Manufacturing	0.58	0.30	0.40	0.30	0.38	0.29
SOE x	3832	Optical Fibre and Cable	0.72	0.29	0.38	0.42	0.27	0.53
SOE x	3841	Lithium-ion Battery Manufacturing	-0.42	0.54	-0.52	0.27	-0.31	0.48
SOE x	3849	Other Battery Manufacturing	0.58	0.51	0.00	1.00	0.18	0.75
SOE x	3851	Home Electric Freezing Appliances	-1.42	0.03	-0.35	0.44	-0.07	0.86
SOE x	3852	Home Electric Air conditioning	0.77	0.11	1.43	0.00	1.22	0.00
SOE x	3855	Home Electric Cleaning Appliances	-1.02	0.26	-0.32	0.61	0.03	0.96
SOE x	3861	Fuel Gas, Solar Energy and Similar Energy Appliances Manufacturing	-0.55	0.47	0.38	0.47	0.02	0.97
SOE x	3911	Computer Machine Manufacturing	-0.16	0.74	-0.08	0.81	-0.11	0.71
SOE x	3912	Computer Parts and Components Manufacturing	1.34	0.10	0.64	0.25	0.18	0.73
SOE x	3913	Computer Peripheral Equipment Manufacturing	0.22	0.73	0.01	0.98	0.19	0.62
SOE x	3921	Communication System Equipment Manufacturing	-0.18	0.69	-0.32	0.32	-0.49	0.10
SOE x	3953	Television Recording and Playing Equipment Manufacturing	-1.65	0.14	-0.20	0.80	0.28	0.69
SOE x	3963	Integrated Circuit	0.24	0.67	-0.27	0.48	-0.37	0.30
SOE x	3969	Photoelectron Parts and Other Electronic Parts	-0.20	0.36	-0.31	0.04	-0.52	0.00
SOE x	3971	Electronic Components and Sets	-0.16	0.75	-0.25	0.47	-0.10	0.76
SOE x	3972	Circuit Printing	0.54	0.40	0.09	0.84	0.25	0.53
SOE x	3990	Other Electronic Equipment	-1.63	0.14	-1.81	0.02	-0.94	0.18
SOE x	4011	Industrial Automatic Control System Equipment	-0.89	0.44	-0.36	0.65	0.07	0.93

SOE x	4343	-0.57	0.47	-0.00	1.00	0.13	0.79
	Province Fixed Effects	Y		Y		Y	
	4-Digit Subsector Fixed Effects	Y		Y		Y	
	Year Fixed Effects	Y		Y		Y	
	Observations	5,287		5,287		5,287	
	R-squared	0.23		0.27		0.32	
	Adjusted R-squared	0.18		0.23		0.28	

English translation of four digit industry code from China Data Online (All China Marketing Research, 2018)